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Auxiliary Machines on Steamships.

WHILE the use of electricity for the propulsion of ships does not appear to meet with any great degree of favour in this country, it is gradually becoming recognised that for driving the auxiliary machinery, the electric motor offers one of the most economical and reliable forms of drive available. We recently drew attention to the rapid development in the use of electricity for driving the auxiliaries on motorships (ELECTRICAL REVIEW, January 8th, p. 47), and by a strange coincidence, in a paper entitled "High Efficiency Steam Installations for Ship Propulsion, with Special Reference to the Question of Auxiliary Machinery," read on Tuesday last before the Institute of Marine Engineers, the author, Mr. Stanley S. Cook, dealt with the advantages of using electricity on ships propelled by steam engines. The motorship is, of course, in a different category to the steamship as regards the driving of its auxiliaries, as it would be obviously impossible to use a small oil engine for driving each of the auxiliary machines. The steam engine, on the other hand, can be built for very small powers, and on many steamships the bulk of the auxiliaries are driven by separate small steam engines. Indeed, in comparing the economy of the different forms of auxiliary drive available on board a steam-engine-driven vessel, Mr. Cook considered first of all the steam drive, for which, as a result of actual measurements made under service conditions, it may be said that the fuel consumption of the auxiliaries represents about 15 per cent. of the total consumption of the vessel.

Three alternative systems are, however, available, and in this paper a comparative estimate is drawn up for each of these for a cargo vessel of average dimensions propelled by steam turbines of 5,000 shaft horse-power. In the first of these a turbo-generator is employed, the turbine receiving high-pressure steam, and thus working under the most economical conditions, while the auxiliary machines are driven by electric motors. In the second alternative a Diesel engine is used to drive the generator, the arrangement being otherwise as before; and in the third, the auxiliaries are mechanically driven by the main engines. The last-named system need not be seriously considered despite its economy, as it is not favoured by marine engineers owing to the

vibration which it causes in the turbines and the gears. The steam-electric and the Diesel-electric drives effect a considerable saving in fuel as compared with the steam drive, the figures given by Mr. Cook showing that after all possible allowances and corrections have been made with the steam-electric drive, the total fuel consumption for the vessel, *i.e.*, main engines and auxiliaries, is reduced by 2.85 per cent., and for the Diesel-electric drive by 7.6 per cent., with the same main engines in each case. Thus, taking 15 per cent. of the total consumption as representing the consumption of the steam-driven auxiliaries, it will be seen that the use of the electrically-driven auxiliaries reduces the fuel consumption of the auxiliaries by 19 per cent. in the case of the turbo-electric drive and nearly 51 per cent. in the case of the Diesel-electric drive. It is apparent, therefore, that the use of electricity for driving the auxiliaries on a steamship yields a very considerable economy in fuel consumption, and at the same time there are the considerable advantages which are inseparable from the use of small, high-speed rotary machines instead of the slower and therefore larger and heavier reciprocating machines. There is thus considerable scope for the production of electrical machinery specially suited for the conditions met with on cargo steamers.

Battery-charging Stations.

THE rapid development of broadcast radio-telephony has reacted on the electric accumulator-charging business, and battery-charging stations have consequently been established in somewhat large numbers all over the country. We notice that one of the motoring journals considers that many of the new stations are of mushroom growth and are run by men with very little electrical experience; its complaint that numbers of accumulators are daily being ill-treated, or permanently injured, confirms our own opinion on the subject.

On the principle that there is no smoke without fire, it may be assumed that there is some justification for the criticisms above quoted. In view of the fact that practically all motor vehicles are nowadays fitted with accumulators for lighting and engine-starting purposes, there is no doubt that there are plenty of excellent opportunities for profitable business in battery-charging and maintenance; not only is there a considerable demand for similar service from hundreds of thousands of users of radio-telephone apparatus, but also an increase in the number of the conveniently-located depôts which cater for the needs of battery-propelled vehicle owners would influence electric vehicle progress considerably.

However, for such a business to be a success, it is imperative that it be conducted on the right lines, from the point of view of both equipment and expert supervision. This fact has been realised by some of the principal battery-making concerns, which in recent years have organised excellent "service" and hire-maintenance systems, selecting for such work only establishments that may be relied upon to give satisfaction to customers and so assist in building up the makers' business and goodwill. It would appear that neither all battery-charging concerns nor all electricity supply authorities quite appreciate the mutual benefits that will accrue from arrangements that permit of accumulators being charged at such times as will not coincide with the generating station's peak load, and the adoption of other measures which will assist battery users to obtain charging energy at a reasonable cost. The price demanded for re-charging batteries, in the case of "wireless" accumulators at any rate, is far too often out of all proportion to the "service" rendered and the electrical energy utilised in the process.

It behoves all whom "the cap fits" to see to it that any grounds for complaint are removed forthwith, otherwise they will realise when it is too late that the future of their individual businesses has been seriously affected by the more satisfactory service rendered by the really efficient establishments.

Wireless Trade Organisation.

A GOOD deal of interesting matter has been appearing in the wireless papers for several months past regarding the chaotic position of the radio-apparatus trade. We quoted some notes on the matter in our last issue, and further references are reproduced in our "Business Notices" to-day. A significant comment appears in the current number of the *Wireless Trader* under the heading "The Locarno Spirit." Our contemporary's considered policy has been the establishment of "one strong representative association for the regulation of the wireless industry," but though it has received views from many quarters on the policy of the N.A.R.M.A.T. and the efforts to evolve "a satisfactory trade government," it has decided to postpone their publication at present, in the interests of peace. It has been led to adopt this course because it understands that substantial progress "is being made toward the reconciliation of the views of all parties to the controversy" and in the hope that the time "may have arrived" when "the least said, the soonest mended." The electrical industry having passed through many similar periods of trial in the course of its progress toward efficiency of organisation, views with sympathetic interest and optimism the efforts of this lusty member of its family to establish itself upon a satisfactory and lasting foundation.

Co-operative Protection Against Fraud.

THE way of the trader is beset with many difficulties, and not the least of these is the existence of a large number of dishonest people who obtain goods and resort to numerous tricks to avoid paying for them. Certain branches of the electrical industry are particularly affected by these practices, and there have been many cases in which dozens of firms have been swindled of thousands of pounds by these parasites of trade. Some of them operate in a most astonishingly brazen manner, and their nefarious actions can be recognised for months before they can be brought to justice. It is then too late: the imposition of a term of imprisonment may act as a warning to others dishonestly disposed, but it brings only poor consolation to a trader who has been defrauded of hundreds of pounds' worth of goods. In these circumstances the F.B.I.'s scheme of co-operative protection against this kind of fraud should be of inestimable benefit to those who take the trouble to participate in it. It is extremely difficult for the Press to secure the necessary detailed information to enable it to expose offenders so as to cut short their practices. We have had some experience ourselves in trying to do so, and know only too well how definite must be the reported offence before the police can take the initiative; therefore full use should be made of the confidential exchange of information arranged by the F.B.I. system, as this appears to be both safe and efficacious. Elsewhere in this issue we publish a note on the methods adopted by defaulters. While these will be familiar to most of our trade readers, they may be put on their guard against very plausible scoundrels of undoubted, if misapplied, ingenuity, and be persuaded to take part in the endeavour to purge industry of these undesirable elements.

The Origin of the Electricity Scheme.

WHENEVER any great scheme of national importance is adopted, there must necessarily be a large number of persons to whom credit is due for bringing it to pass; and this applies to the Government's new proposals for electricity supply. We have seen many claims regarding this in the daily Press since Mr. Stanley Baldwin made his announcement, but not a single reference to the real author. It is rarely that the true and undisputed origin of any far-reaching scheme is so clear as in this instance. We need only refer our readers to the *Journal* of the Institution of Electrical Engineers, dated June, 1916, which contains a record of the paper on "The Electricity Supply of Great Britain," read by Mr. Ernest T. Williams, O.B.E., M.I.E.E., on April 13th, 1916, before the Institution in London, and discussed in London and

Manchester.* Many leading electrical engineers took part in the discussion, which would doubtless have been taken up by the lay Press had not war news overshadowed everything else.

The Institution appointed a Committee to consider the subject in the light of Mr. Williams's paper, which made recommendations to the Board of Trade Committee on Electrical Trades; and later the Committee presided over by Sir Archibald Williamson was set up, whose report brought the matter into the forefront. The Electricity (Supply) Act of 1919, which, *inter alia*, set up the Electricity Commission, was the first step in carrying out Mr. Williams's scheme. Regarding this, the chairman of the North-Western Centre of the I.E.E., in 1919, Mr. J. A. Robertson, stated that "the first actual step in this direction was taken by the reading of Mr. Williams's paper before the Institution early in 1916. This paper put forward bold comprehensive proposals for national electricity supply under a Board of Commissioners in London. The scheme included the erection of super-stations, transmission lines, and supplies in bulk to local authorities over districts to be set up by the Commissioners." About the same date the Chairman of the Western Centre, Mr. Arthur Ellis, said: "You will no doubt remember that very instructive and interesting paper which was read before the Institution by Mr. E. T. Williams in 1916. . . . Mr. Williams has undoubtedly done a great and lasting service to the country." In reviewing the question we find that the Government's present proposals are in fact the completion of Mr. Williams's original scheme, which dealt with the electricity supply of the country as a whole, and aimed to encourage its development not by nationalisation but by the encouragement of private enterprise under an Electricity Board, working on commercial lines without a subsidy and without dispossessing existing undertakers. Indeed, we may say in brief that the only real difference between the Government's proposals and those put forward by Mr. Williams in 1916 is that, whereas Mr. Williams proposed one Board to deal with the whole problem on both its administrative and executive sides, the Government apparently intends to leave the administrative work in the hands of the present Electricity Commission constituted under the Act of 1919, and to set up a new Electricity Board with executive powers for dealing with generation and transmission, to be responsible to the Electricity Commissioners.

Whatever views may be held as to details of the scheme, there can be no question that Mr. Williams was the author of all its essential features, and we trust that he will receive that recognition to which he is entitled.

The German Steel-Electrical Combination.

We have already referred to the big scheme for the constitution of a German coal and iron and steel trust that will combine most of the collieries and iron and steel works at present owned separately by the Thyssen group, the Rhine-Elbe Union (represented by the Deutsch-Luxemburg Company, the Gelsenkirchen Company and the Bochum Verein), the Phœnix Steel Works Company and the Rhenish Steel Works Company. The proposed amalgamation has taken provisional form by the establishment of the Ver. Stahlwerke A.G. (United Steel Works Company) so as to prepare the way for the definite creation of the combination under this title with an ordinary share capital of £35,000,000, and a controllable production of, say, 6,000,000 tons of steel per annum, and a still larger output of coal and coke. As there is every prospect of the constitution of this trust being realised—for such realisation now depends upon the question of the settlement of the taxes payable on the formation of the company and upon the successful financing of the undertaking—the change will naturally be accompanied by an alteration in the relations which have existed for some years past between the Rhine-Elbe group, the Siemens and Halske Company, and the Schuckert Electricity Company directly, and the Siemens-Schuckert Company indirectly. Having regard to these circumstances, the Siemens and Halske Company has issued a communication stating that the constitution of the trust will affect in important points the community agreements which were concluded between this Berlin company, the Deutsch-Luxemburg Company, the Gelsenkirchen Company, and the Schuckert Company. On all sides, the Company states, the wish is expressed for the future maintenance in some form of the close and friendly relations which have developed between the interested firms and their managers during the years of co-operation, in order in the first place that no interruption may occur in the work carried on in common for the promotion of technical development. From this point of view negotiations as to the future relations between the interested parties will shortly be begun.

At present a method of pooling the profits exists under the community agreements, but having regard to the transfer of the coal and iron and steel properties to the new trust, this system will come to an end with the actual formation of the trust. This then is one of the important problems which will be subject to revision, while a second relates to the directorships held by representatives of the Rhine-Elbe Union on the boards of the electrical manufacturing companies. Under these circumstances the latter will secure greater freedom of activity than has prevailed during the past few years. In this connection it is stated that the idea has arisen for constituting a European (?) electrical trust in which the Siemens-Schuckert works would participate in a manner similar to the participation of the Rhine-Elbe Union in the steel trust, but for the moment no information is available on this particular point.

The Cost of Electrical Energy.

In our issue of January 1st we published an article, based on the Electricity Commissioners' Statistical Returns for the last year available (1923), showing how the quantity of fuel consumed per kilowatt-hour generated varied with the output of a large number of generating stations. Whilst full allowance must be made for the lack of completeness of the data, the results recorded were extremely interesting, and in some respects surprising.

We now print in this issue a second article by the same competent hand, and based upon data from the same inexhaustible source, in which a comparison is instituted between the cost of electricity to the consumer, as represented by the average price obtained for it, and the output of the undertaking by which it is supplied. Here, again, some allowance must be made for varying conditions which do not appear in the statistics; but in this case the comparison is less open to criticism, and the results are equally noteworthy and significant. Whatever differences may obtain in respect of the load factor, the date of purchase of the plant, the situation of the undertaking, the nature of the district, and similar considerations, they are likely to affect both small and large stations in the mass in much the same way; and at any rate, the best results obtained can reasonably be compared as indicative of the relative performances of the undertakings. Coal varies over a wide range of quality, and some of the largest stations use very low-grade fuel, which on a weight basis makes a bad showing, but there is no such variation in the value of pence; the cost of the energy supplied is, in journalistic jargon, the "acid test," which appeals even to Cabinet Ministers. If a station cannot supply cheap energy, it will fail to satisfy the examiners who are to sit on the Executive Board. On the other hand, if a station can and does supply cheap energy, on what grounds can it be condemned? Merely because it happens to be a small one?—Some of our smaller stations are in this sense amongst the most efficient.

We do not advocate the cause of the small station *versus* the big one; we merely appeal for common sense in dealing with the question of electricity supply. Large industrial communities must necessarily be served by large power stations, but it does not follow that small ones cannot as economically, efficiently, and expediently be served by smaller stations; that is a proposition which remains to be proved.

* ELECTRICAL REVIEW, April 21st, May 19th, and May 26th, 1916.

The Relationship between Cost and Output.

A Comparison of some Electricity Supply Undertakings.

(Communicated.)

It has been shown in a previous article* that, as the size of power stations increases beyond an output of about 10 million kWh per annum, there is, generally speaking, no particular decrease in the coal consumption per kWh generated. Whether this is as it should be is another matter, which need not be discussed now. The circumstance, however, prompts a further inquiry, namely, whether the larger undertakings are able to sell electricity at prices much, if any, lower than the smaller ones, and if so, whether there is any limit of size beyond which any further increase in magnitude has no advantage to the consumer. For the latter, provided always that his supply is reliable, has no interest in anything but price. He does not care what the coal consumption may be, nor what the capital charges or running expenses may amount to. His only concern is to get his electricity at the cheapest price, and he wants neither explanations nor excuses.

The duty of an electricity undertaking is to give the consumer cheap electricity, and it is granted a monopoly on the understanding that it will do so. "Cheapness," of course, is a relative term, but so is "reliability," and so are a good many other words, the meaning of which is well understood. Again, electricity for lighting may be cheap and electricity for power may be dear in one and the same area. Rates may be varied as between different classes of consumers, either on the principle of "what the traffic will bear," or in accordance with a deliberate policy of encouraging the use of electricity for particular purposes. Rates, however important, are a matter of detail. The real test of the service of an undertaking to the community is the average price demanded per kWh for all purposes. The community as a whole is made up of individual consumers, and the less the aggregate amount of money extracted from their pockets in return for the electricity they consume, the better, on the average, are they served.

From this point of view it is interesting to see what are the average prices charged by undertakings of different sizes. Although some may be more fortunately situated for cheap supply than others, it is possible by taking a sufficiently comprehensive survey to arrive at some idea of how the cost varies with output. Stations of any particular size are not confined to any one locality, so that the good fortune of one will be offset by the bad fortune of another, if a fair number of undertakings are considered together. Graphical methods afford by far the best means of demonstrating relationships such as those we are considering. The whole of the facts correlated are brought under review simultaneously, and the eye can strike an average, or observe the trend of events, far more surely from a diagram than from numerical tables. Hence data bearing on the relationship of selling price to output of electricity abstracted from the "Return of Engineering and Financial Statistics" of the Electricity Commissioners are presented graphically in fig. 1. The points in this diagram refer to 153 electricity undertakings having outputs of less than 20 million kWh per annum. Undertakings of larger size will be considered separately.

* ELEC. REV., January 1st, 1926; p. 5.

For the purpose of the diagram, the whole of the local authority undertakings in England have been brought under review. Company undertakings, which are listed separately in the Commissioners' Return, are left out of consideration merely to keep the number to be dealt with within reasonable limits. There is, however, no reason to suppose that the relationship between price and output would be substantially different were the company undertakings included. Another class of undertakings which has been omitted from the diagram is that in which the whole, or the greater part, of the electricity supplied is purchased from some other undertaking. There are altogether 42 of these, mainly, of course, quite small in size, but since many of them are able to purchase energy from large power companies at very favourable rates, it would have been misleading to have brought them into comparison with local authorities of equal size which have to generate their own supplies. The only other undertakings omitted are a very few for which information was not available, and three little ones whose average selling price was more than 8d. per unit.

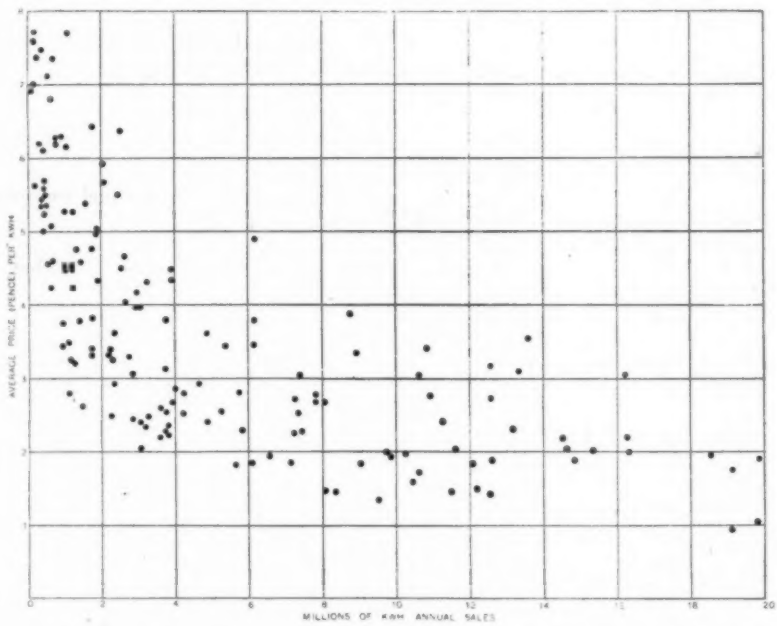

Fig. 1.—Price and Output of Electricity Generating Stations, under 20 million kWh per year.

Every undertaking is represented by a point corresponding to the total number of kWh sold during the year ending March, 1923, and also to the average selling price per unit. Circumstances will have altered slightly since the date of the return, but it is unlikely that the general conclusions would be much altered were the comparison to be made to-day. A glance at the diagram is sufficient to show how widely the price varies as between different undertakings. With a few exceptions, both above and below, the average price charged by undertakings with outputs of less than a million lies between 4d. and 8d. The next group, with outputs of from one to two millions, charges on an average between 2.5d. and 5.5d. Prices continue to get better till an output of 4 millions is reached, and after that, although there are some good undertakings between 8 and 13 millions, what improvement there is is slight and erratic.

Had the undertakings purchasing all or the greater part of their electricity been included, the advantages of this course in the case of small systems would have been strikingly manifest. There are, for example, nine

local authorities selling less than five million kWh each annually which can afford to retail the energy at an average price of less than 2d., a feat which is not possible in any case where these small outputs have to be separately generated. Four of these authorities indeed can charge less than 1.5d., and two actually less than 1d. Of the local authorities with sales of less than five million units, the Stafford Corporation easily leads with an average price of only 2.04d. for a sale of only 3.078 million units. Stafford generates the whole of its electricity itself, and with a coal consumption of 4.02 lb. per kWh and a load factor of only 19 per cent., it undoubtedly is selling cheaply. Worcester is another fortunate city. Like Stafford, it produces the whole of its power, and manages to retail it at an average of 1.82d. per unit, with total sales of only 5.670 millions. It certainly has two little water turbines aggregating 320 kW capacity at Powick, but these only amount to about 6½ per cent. of its total plant, the rest being steam. Gravesend is to be congratulated also on selling 6.081 millions, all generated by the Corporation, at an average price of 1.85d. The fuel consumption of 2.61 lb. per kWh is also very good for so small an undertaking, and this, together with the sale of 130 B.th.u. per head of population at a load factor of 34.4 per cent., also indicate sefficiency of management.

The smallest local authority undertaking able to sell energy at an average price of less than 1.5d. is West Hartlepool, which charges only 1.48d. for its 8.078

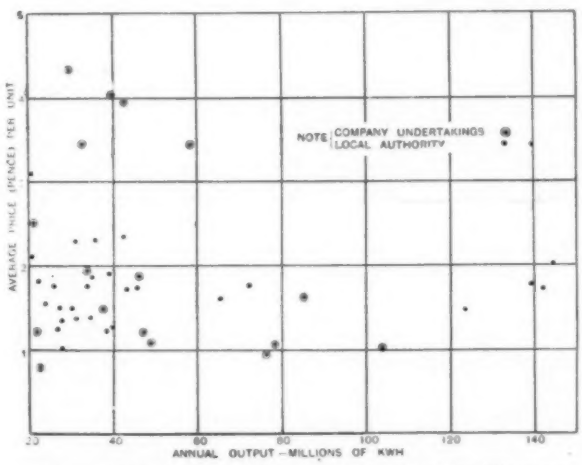

Fig. 2.—Price and Output of Stations, from 20 to 150 million kWh. per year.

million units, but nearly 2.4 million of these are bought wholesale from a power company. West Hartlepool, moreover, rejoices in a load-factor of 39.9 per cent., so that its capital charges are proportionally reduced. The Rawtenstall Corporation has neither of these advantages, and so its price of 1.46d. for 8.370 million units is extremely creditable. It generates the whole of its electricity itself, with a coal consumption of only 2.30 lb. per kWh, and shows what can be done with good management in a little station with five generating sets averaging only 1,900 kW each. The Darlington results are also rather remarkable. Here we find 9.527 million units, all generated by the Corporation, sold at a price as low as 1.35d. The load-factor is not good, being only 22.5 per cent., and the coal consumption of 3.44 lb. per kWh is by no means very good either. The only other authorities to sell below 1.5d. are Lincoln, with 11.513 millions at 1.46d.; Luton, with 12.197 millions at 1.49d.; York, with 12.547 millions at 1.43d.; St. Helens, with 19.136 millions at 0.96d.; and Bury, with 19.823 millions at 1.05d. The fuel consumptions of these five undertakings are respectively 2.31, 2.84, 2.78, 2.52 and 2.44 lb. per kilowatt-hour.

We will now turn to the consideration of undertakings with annual sales of from 20 million kWh to 150 million kWh. As these are less in number than the smaller ones, all that there are in Great Britain, whether owned by companies or local authorities, will be taken together. The prices charged by these undertakings are plotted in fig. 2 over their respective annual outputs; the local authorities being designated by plain dots and the companies by dots surrounded by circles. As will be seen from the diagram, both the dearest and the cheapest prices are charged by company undertakings, the extreme limits being an average charge of 4.34d. on an output of 29.624 million units by the Metropolitan Electric Supply Co. and an average of 0.79d. on an output of 22.170 millions by the Mersey Power Co. The latter company has a load factor of 45.1 per cent. against 23.8 per cent. for the Metropolitan Co., but even this seems hardly adequate to account for the difference.

Besides the Metropolitan Co., there are four other companies and one local authority which charge more than 3d. as an average price for their energy. The local authority is Nottingham, where 3.10d. is charged on an output of 20.402 millions. At the date of the return, the Nottingham coal consumption, however, amounted to the frightful figure of 6.15 lb. per kWh, and matters should be very different now that the new station is in operation. The four companies which come into the same class as regards price are all, like the Metropolitan Company, concerned with the supply of London. One of these, the Westminster Electric Supply Corporation, purchases nearly five-sixths of the energy it sells, but since the company it buys it from only receives an average price of 1.19d. for its product, the purchase price hardly seems to account for the selling price of 3.45d. per unit. Even so, however, this is a lower price than that charged by any of the four other companies mentioned.

After the Mersey Company, in point of cheapness comes the excellently-managed Lancashire Power Co., with an average price of 0.95d. for an output of 76.156 million. This company has the extraordinarily low fuel consumption of 1.80 lb. per kWh. The cheapness of electricity in many small towns in Lancashire is primarily due to the operations of this company, which supplies in bulk at a very low price for distribution by the local authorities. Lancashire is indeed generally fortunate in its electricity supply, no other area, except the North-East coast, being better served. Within the range we are considering, the Stalybridge Electricity Board comes next after the Lancashire Power Co. in respect of price, as it charges only 1.01d. on an output of 27.727 millions. The undertaking having the largest output dealt with on the diagram is that of Liverpool with 144.444 millions. The price of 2.01d., it may be noted, is also high, exceeding that of any other undertaking with a sale of over 60 millions.* It would appear from the diagram that any price exceeding 2d. per kWh on an average may be considered high for undertakings ranging from 20 to 150 million kWh annual output. The smaller plants, also, seem to be able to sell as cheaply as the larger ones, especially if we omit certain London undertakings whose charges rise to such ignoble eminences.

The only two undertakings with outputs exceeding 150 millions are those of Manchester Corporation and the Newcastle-on-Tyne and associated companies. The Manchester output is 185.639 million kWh, which is sold at an average rate of 1.77d. per kWh. The Newcastle undertaking sells 442.873 million kWh at an average price of 0.76d.

Throughout this article the present tense has been used, although the figures are not now quite up to date. They are, however, the latest that are available, at any rate in a form convenient for reference. Even did they completely reflect the circumstances of the moment, they must in all cases be interpreted with reference to local conditions. The instructed reader will be able to draw his own conclusions from them, especially if they are examined in conjunction with the vast amount of other data contained in the Return from which they have been taken.

* The Liverpool figures cover a period of fifteen months, and include those for the undertakings of Bootle Corporation and the Liverpool District Lighting Co., which were acquired in 1922.—EDS.

Some Troubles of a Lighting-Set Maker.

By "SARCASTICUS."

THERE is an attraction in the manufacture of house-lighting sets from which few of the engineering industry are exempt. The engine maker, the electrical contractor, the agricultural engineer, the ironmonger, the factor, all at times fall victims to its lure, and embark lightheartedly upon the manufacture of yet another "Brown-Light" or "Jones-Light," as such plants are usually named. In the attempt to analyse the fascination which this trade exercises over the imagination of the hard-headed man of business, let us peep through the morning mail of a typical maker, and see what the day brings him in the way of opportunities of service to the public, help to the trade, and possibly a little profit for himself.

Inquiries.

If our maker has only lately entered the field, he will be agreeably surprised by the number of inquiries which have followed his *début*. Apparently the new plant fills a want hitherto unsupplied by the well-known and long-established makers, whether of English or foreign origin. A little later on he will perhaps also be surprised (this time disagreeably) at the proportion of such inquiries which his various sales experts are able to turn into orders. The reason for the initial flood of inquiries is not that there are several hundred people who are wanting to purchase electric-lighting plants, but have purposely refrained from doing so until the appearance of the new set overcame their hesitancy; it merely indicates that there are this number of people interested either in the manufacture or the marketing of competing sets who naturally wish to find out for themselves whether the new make is going to mean any serious competition for them either on the score of price or efficiency. The new maker will also as time goes on be able to remark how curious it is that the moment the largest maker periodically drops his list prices yet another £5 all round, agents for both this and other sets send out wholesale prices to every known manufacturer for prices of lighting sets, many of them so cunningly worded that the optimistic might almost be led to believe that there were numbers of orders ripe for placing.

Extent of the Market.

The total turnover which is being done in lighting sets throughout the country is apt to strike the newcomer as truly terrific considering the general state of trade in other directions. It would be indeed difficult to find the contractor who would be so modest (or so truthful) as to confess to installing anything less than two or three dozen of these per annum, and when we multiply this number by the total number of electrical contractors throughout the country handling such business, we shall see what a truly vast field there is for exploitation by the pushful maker or the energetic salesman in this line. The resulting roseate figure is confirmed (to a certain extent) by the details which we hear from time to time of the total number of sets which certain manufacturers and certain importers sell during a normal year. A "normal" year, I may explain, is, in the average maker's opinion, the turnover for the year 1919-1920 multiplied by a certain factor which varies from 2 to 6.

Sales Resistance.

Nor does the "sales resistance"—to quote a much-used American salesmanship term—appear to be so high as might be expected. Not only does every contractor and dealer seem to do a large and regular business in installing such plants, but in addition the morning's mail will show that a large number are prepared to back up their claims by taking a set upon "sale or return" terms, and exhibiting it in the showroom free of all charge whether for rent or attendance. There is perhaps observable a certain reluctance to discussing the question of ultimate payment and certain other details of the loan, but this is of course due entirely to the fact that the maker's set is unknown in that particular district. "Clear-Light" and "Glow-Light" sets have been selling there in huge numbers, and the inquirer has no doubt that the new set will sell at sight—if it is really as good as the maker's catalogue states! Of sales resistance in the case of actual business I will not now speak, excepting to say that it is slightly more difficult to overcome.

Service not Profit.

If our glimpse through the mail bag of such a maker is made anywhere about the tenth of the month, we may be excused for wondering whether the standard of engineering knowledge in this country is quite so high as we had supposed, to judge from some of the curious complaints which are received. This feeling of pessimism, however, will be corrected if we draw upon our commercial experience and remember that this is a time of the month formerly dedicated to the payment of accounts and the signing of cheques, but now devoted chiefly to the penning of complaints. In the majority of cases, a complaint of any kind is good for another month's credit at the least, and if it is addressed to a maker who is thoroughly imbued with the spirit of free service, it will also bring such assistance as is truly surprising.

Our first letter of this kind, which causes a gloom to settle over the establishment, is to complain that the semi-automatic plant tested so carefully before despatch and upon installation will not start, and unless it is put right that same day it will be thrown out into the street, &c. A little journey of some hundred miles on the part of a mechanic shows that the battery has been discharged to such an extent that there is not sufficient current to motor the generating set round and start the engine firing; and the mild suggestion that in such a case the starting handle is really the cheapest and easiest method of getting the engine under way, provokes the stern rebuke that the plant was supposed to be fool-proof, and that such an occurrence should not be possible.

The next letter which (following hard upon the last) seems likely to provoke a sudden heart attack, is to say that another engine cannot be induced to start, that the whole countryside is watching the trouble which is being experienced, and that it is likely to spoil all chances of future business in that neighbourhood for another twenty years. This time it is a journey of a couple of hundred miles, and upon arrival the mechanic is mystified for a full couple of minutes until he turns his attention to the "petrol" which is used for starting purposes, and finds that a lighted match fails to ignite it! A walk over to the nearest garage, the purchase of a tin of real petrol, and another troublesome complaint is satisfactorily settled. Upon other "serious complaints" which involve the changing of a sparking plug, or the timely replenishment of lubricators, space and still bitter recent experience will not permit me to dilate.

The Electrical v. The Agricultural Market.

But whatever may be the occasional shortcomings of an interesting trade, there is little doubt that to the maker of small oil engines it has opened out a market which is vastly more satisfactory than the agricultural trade, upon which (prior to the advent of the house-lighting set) he had to rely for the majority of his home sales. Only those who have had to deal with the agricultural trade for a few years, and consequently are acquainted at first hand with its slow and uncertain methods, who know the number of years which it takes a farmer to make up his mind that he requires a 6-h.p. engine, and then the number of years over which he thinks payment should be spread, and the vastness of

the allowance which he requires upon the chaff-cutter (date *circa* 1850) tendered in part payment, only those will realise with due thankfulness that the electrical market, in spite of its occasional shortcomings, offers a greatly more lucrative, a more business-like, and a more satisfactory field than the old. On a bad day, a maker may be tempted to abuse the electrical contractor, but honesty will compel us to admit that, compared with some others, he is almost free from fault.

A little time spent in perusing the daily post of an average maker will quickly show that at the present time the manufacture of house-lighting sets offers more opportunities for service than for profit, but with the coming of better trade and the circulation of more money, it is probable that many of the difficulties which confront such a maker will be banished, giving place to a state of things more nearly resembling the idealistic picture which an outsider is accustomed to regard as a true presentment of a manufacturer's position and emoluments.

Electrical Traders' Accounts.

The Special Features of Practical Book-keeping for Electrical Traders.

By S. HOWARD WITHEY, F.C.I., &c.*

HAVING regard to the quantity and the variety of equipment, appliances, &c., in which the electrical trader now deals, it is very necessary that a good and appropriate system of internal check should be instituted, and it is in close relation to internal check that the trader's accounting and book-keeping should be based.

Commencing with the orders received, which are the real foundation for all the subsequent entries in the books of account, it will be found convenient to record these in a manifold order book, one form being used for each order. The original sheet will, in each case, be passed on to the person or department immediately concerned in the execution of the particular order, the copy being retained in the manifold book. As soon as an order is fulfilled, the original sheet should be cancelled, and the price extended into the cash column in the manifold book, which will then constitute a kind of rough sales book and order book combined. All unfulfilled orders of unduly long standing should be immediately investigated to prevent any being only partially fulfilled, or overlooked altogether. All orders, without exception, should be recorded in this manifold book, whether they have come to hand through the post, from agents, travellers, salesmen, &c., or have been received verbally.

The credit sales transactions should either be passed through a printed day book, or sales book, or a duplicate invoice book should be kept. Both these methods have their peculiar advantages. If the printed day book method is adopted, the book should be ruled with additional money columns to enable the various transactions to be systematically classified under their appropriate headings, such as "Cables," "Fuse Cases," "Dynamos," "Tubing," "Bends," &c. Duplicate invoice books are best kept on the pen carbon-copy principle, the original forms being the actual invoices sent to the customers and trade debtors, the copies constituting the book of original entry from which the personal accounts will be debited in the sales or customers' ledger. Care is necessary to ensure that any alteration made on an invoice after it has been torn from the duplicate book is effected, also, on the copy; otherwise the sum charged against the customer in the traders' books will most probably be incorrect.

Instead of having a separate sales account for each different class of sale, such as "Dynamos Account," "Cables Account," &c., it is much better to rule extra columns on the credit side of the general sales account, these columns being headed to correspond with those under which the sales transactions have been dissected.

If the number of returns inwards transactions is at all considerable, a separate sales returns and allowances book should be kept, consisting of copies of all the credit notes actually sent out by the trader. The entries made in this book will be analysed in the same manner as the sales book entries, and the monthly totals should be deducted from the corresponding monthly totals of the sales book, and before the latter are posted to the credit side of the sales account. In those cases where the number of returns inwards transactions is really few, they could be recorded in the end section of the sales book.

The amounts recorded in the purchase book, or bought journal, should be in accordance with the details shown on the invoices received in respect of equipment, appliances, materials, stores, &c., purchased. Separate analytical columns should be ruled for the classification of the purchases under the particular headings, and also for the various expenses as these become payable, in order that the totals may be readily available for posting purposes. The entries shown in the purchases returns and allowances book should be numbered in consecutive order with the credit notes actually received by the trader and filed, the monthly totals being deducted from the monthly totals of the purchase book.

If irregularities in the matter of cash are to be prevented, the trader should personally open all letters, &c., received, and should, at the same time, make a note in a private diary of all cash received. The system should provide for all cash received, whether in the form of cheques, bills, drafts, notes, coin, or postal orders, being paid into the bank intact, and by ensuring that all amounts entered in the diary have been actually deposited, the possibility of irregularities will be reduced to a minimum. An alternative method of controlling the cash received may be adopted by the trader, consisting of entering each item on the counterfoil of the paying-in book, the detachable portion being filled in later by the person actually paying the money to bank.

When all the cash received, without exception, is paid into the bank, all payments (except, of course, petty cash payments, for which a separate petty cash book should be kept) will be made by cheques, and consequently it will be sufficient to have two columns on the credit or payments side of the cash book, for "discount" and "bank" respectively. It will, however, be necessary to have an extra "cash" column on the debit or receipts side of the cash book, in which will be detailed all the amounts of cash received, the total of these amounts being simply extended into the "bank" column upon paying the cash into the bank. Subject to any unpresented cheques, and any cash paid to bank but not yet credited in the bank pass book, the balance of the "bank" columns of the cash book should exactly correspond with that shown in the pass book, providing all items representing interest, bank charges, &c., have been duly entered in the cash book.

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It is very important that proper distinction should be drawn between capital items and revenue items. In this connection some of the principles which govern a discrimination are illustrated below:—

Goodwill.

The original payment for goodwill is a capital charge, but being an intangible asset, the method favoured by the writer, in the case of the electrical trader, consists of showing the item on the assets side of the balance-sheet at cost, and deducting therefrom any reserves earmarked for writing it off. The position is then very clearly defined.

Repairs and Renewals.

Amounts expended in the maintenance of any asset are charges against the periodical profits. If, however, the real value of the asset is increased by reason of the expenditure, the amount involved should be debited to the account of the particular asset, and an adequate sum written off each year to cover depreciation through wear and tear, obsolescence, or lapse of time.

Leasehold Property.

The cost of buying leasehold property should be debited to the leasehold property account in the trader's private ledger, as also should, for the time being at any rate, all legal expenses incurred in connection therewith. The annual profit and loss account will be debited with all repairs, ground rent, and depreciation to provide for lapse of time, and also with the legal expenses as soon as possible. The cost of extensions to buildings is a capital charge, including any wages paid to the trader's own employés who may have been employed in the extension operations. The amount expended in the repair and maintenance of the extensions should be written off against the profits, as well as annual depreciation.

Plant and Machinery.

The plant and machinery account should be debited with the cost of purchasing new or additional plant or machinery, and also with the cost of carriage paid on it. If any repairs are necessary to make second-hand plant or machinery immediately efficient, the expenditure involved should also be debited to the asset account. Other repairs will be charged against the profits, and also the amount necessary to write off the old asset displaced, and depreciation of the additional plant or machinery.

Fixtures and Fittings.

The cost of installing electric light, telephones, fixtures, &c., is capital expenditure, but all expenses incurred in their maintenance should be charged against the profits.

In the matter of stocktaking, particular care is necessary to ensure that none of the following are included in the stock sheets:—

(1) Any asset, such as plant, machinery, transport, &c., the value of which is shown in a separate ledger account.

(2) Any equipment, appliances, goods, &c., received by the trader for sale on behalf of the consignor, but which have not been included in the periodical purchases.

(3) Any equipment, appliances, goods, &c., which have been sold and included in the periodical sales, but have not yet actually left the trader's premises.

Provision for bad debts may be made by calculating a certain percentage of the total book debts, but the better method consists of carefully examining each item in the list of debtors, making at the same time a sufficient allowance for sums uncertain of collection, or known to be definitely bad. The total of these allowances should be charged against the profits and credited to a bad debts reserve account, the final balance of which will be deducted from the "sundry debtors" on the assets side of the balance-sheet.

After depreciation and all losses and liabilities have been provided for, a reserve may be created, consisting of sums set aside out of the profits, either for the specific purpose of equalising the profits, or in order to strengthen the financial position of the business. A reserve may, however, be undisclosed as the result of an actual appreciation in the value of such assets as investments, land, buildings, &c., or by the omission of such items as goodwill, patents, &c. Secret reserves may consist, also, of excessive amounts charged against the profits to provide for future liabilities, or for depreciation of any asset, or the value of business premises, stock, &c., could be shown at a lower figure than actual value.

In cases where a general reserve has been built up, and patents are a large item, the value of the patents could remain in the trader's books at cost, but much will depend upon whether or not the intrinsic value of the monopoly will really diminish. Renewal fees should, however, be debited to the annual profit and loss account.

Fuel Economy and the All-Electric House.

By E. W. DICKINSON.

THE admirable paper by Prof. S. P. Smith, D.Sc., on the "All-Electric House," read before the Institution of Electrical Engineers on December 3rd last, raised an interesting discussion that evening, and is likely to form the nucleus for lively controversy for some little time to come.

An "All-Electric House" is, of course, a proper ideal for every electrical engineer to have, and to keep well in remembrance of his neighbours, but it is inclined to wilt when looked at from the point of view of the conservation of the nation's fuel supply.

Dr. S. Z. de Ferranti, whose house is out of reach of a distributing main, informed the meeting how he had decided that his own domestic requirements, involving heat, lighting, and power, were best served by converting to useful purpose 60 per cent. of the calorific value of fuel in the shape of oil. This he did, so far as could be gathered, by obtaining light and power in the form of electricity through conversion in an internal-combustion engine generator set, the hot water being obtained from the engine cylinder cooling system. Had the oil been burnt in a super-power station at the present day, probably not more than 17 per cent. of the heat value of the oil would have found its way into the home. One wonders whether Dr. Ferranti, confronted now with an opportunity of obtaining a supply of electricity from the mains for a new home, would jump at it.

Electrical engineers are not yet in a position to drive home with successful argument a statement that electricity is cheaper than coal or gas for domestic heating purposes, nor that its sole use, to the exclusion of gas, results in fuel economy in the widest sense.

It is necessary to take a wide view of this question if we are to do our duty to our neighbour as to our profession. Professor De Baufre, speaking recently at the University of Nebraska, concludes that "civilisation as it is organised to-day, and with it the possibility of leisure from the immediate struggles for existence to be devoted to research and philosophy, to the

arts and pleasures of life, depends more on mechanical power than on any other factor."*

In this country mechanical power is mainly dependent on the energy released by the combustion of our coals. The greater the caution and skill exercised in converting this energy to our needs, the more surely will our reserves of energy be conserved, and the more definitely shall we be able to meet successfully all foreign competition.

For cleanliness and convenience in lighting, and for power purposes in the home, electricity reigns, or will reign, supreme, but for domestic heating the case is not so convincing. Whilst admitting the convenience of the electric radiator, which can be taken to any part of a room, or from room to room, with the greatest ease, and admitting the ready sale of such apparatus, even with electricity at the present price, the case for using electricity for continuous heating should be advanced with caution. The best thermal efficiencies obtained from the conversion of heat in the coal to electricity delivered at the terminals of our super-power stations is from 18 to 20 per cent., with an average, say, of 15 per cent. A further 10 per cent. to 15 per cent. of the electrical energy so converted is lost in distribution. Little objection can be raised to an assumption of 100 per cent. efficiency in the use of electricity as a heating agent in the house; but at the very best only between 16 and 18 per cent. of the original heat value in the fuel burnt under the boilers of a super-power station is available as heat in the home.

In the case of the destructive distillation of coal in an up-to-date gas works, gas and coke are produced containing respectively 25 per cent. and 50 per cent. of the original heat value of the fuel. The remaining 25 per cent. represents the loss in manufacture, and includes the energy used to disintegrate the raw coal as well as the power used for charging the gas holders. It therefore includes the distribution losses of the gas between the works and user.

The loss in heat when gas is burnt by a mixture of air by means of gas ring, oven, and gas fire may be taken, on an average, to be about 50 per cent. in a normal household. The loss is due to the escape of hot unwelcome products which must be carried away and do pollute, it is true, the outer air; but they perhaps help to ventilate the house, and in any case do not produce smoke.

In the case of coke, one may say that, used in an open fire, it delivers 25 per cent. of its heat into the room; and when used in a closed stove, 50 per cent.—say 35 per cent. on the average.

From these reasonable premises we come to the conclusion that, using electricity in the home for heating, cooking, and washing, about 17 per cent. of the original heat of the coal fired in the power station is available; whereas by the destructive distillation of coal, forming gas and coke, about 30 per cent. is retained for similar domestic purposes:—

Original c.v. of coal at gas works.	On leaving gas works Per cent. of original c.v. of coal.		Efficiency in use	Available as useful heat in the house.
100%	Gas	25%	50%	12½%
	Coke	50%	35%	17½%
	Total			30 %

If we burnt the coke in the power station under boilers on, say, the sandwich system, instead of 30 per cent., we would have available 21 per cent. of the original c.v. of the coal:—

Gas, 12.5% + coke (17.5% of 50%)
= 12.5% + 8.75.
= 21.25,

and at the same time we would have avoided the necessity of using raw coal at the electric power station to the extent, roughly, of the weight of coke used. There and at the same time we would have avoided the neces- would be a gain here through diminished emission of smoke from the power-house chimney.

When confronted with hard facts of this character it behoves electrical engineers to advance with caution, and in this attitude of mind it might be well that they should admit the superior position held by gas where it is superior, and see in what directions advance can economically be made, little by little, with real hope of success.

One of these directions may be indicated by asking why the electrical industry should not consider marketing a gas-electric cooker, the top (or "hot plate") of which would be fitted with a gas grill and rings, and the oven heated with electricity? A pudding in a pan, or a stew in a pot, is unaffected by the gas fumes from the hot plate, but what an unwholesome idea it is to surround "bakes" and "roasts" with the heated and noxious products of gas combustion! Those who know the difference between the taste of a joint roasted in an electric oven, or by the wasteful wood- or coal-fired kitchener, and one roasted by gas will appreciate this suggestion.

Another direction in which the day use of electricity for domestic purposes might be promoted with advantage and profit to all concerned, lies in easing and facilitating the labour of the weekly wash. Dr. Margaret Fishenden has pointed out the substantial economy of the coke-fired domestic hot-water supply boiler, and the gas-heated electric washing machine also tends materially in this direction by eliminating the need for a separate coal-fired wash copper.

Electrical enthusiasts (and the author is one) who still describe gas as a "dangerous explosive" may regard these suggestions as an attempt at an unholy alliance with the enemy; but meanwhile, the only economically available means must of necessity be related to desirable ends.

Advances will, without doubt, continue to be made in the use of electricity; but the *all*-electric house does not appear to be within the bounds of economic possibility in this country at present.

* *The Times*, January 11th, 1926.

National Electricity Supply.

Conferences and Consultations.

ACCORDING to the daily Press, the series of meetings arranged by the Minister of Transport with representatives of the interests likely to be affected by the Government's electricity scheme (including the electrical manufacturing industry, the Joint Council representing power undertakings, and the gas industry) have indicated that the proposed Bill is destined to have an easier passage through Parliament than was at first anticipated by the Government.

It is understood that the subject is to be discussed at a meeting arranged in Birmingham by the South-Midland Centre of the Institution of Electrical Engineers and the Institution of Mechanical Engineers.

Birmingham Chamber of Commerce.

The Council of the Birmingham Chamber of Commerce, at a meeting on January 25th, decided to address a communication to the Board of Trade urging that before any definite proposals for the reorganisation of the electricity supplies of the country are placed before Parliament the opinions of the manufacturing and industrial interests of the country should be consulted.

Mr. GILBERT C. VYLE, in moving a resolution embodying this decision, said the Prime Minister had brought forward an electrical proposition, from which they could only gather some faint comfort. He had suggested that such areas as Birmingham, the Clyde, and part of the North-East Coast, which were on the 25-periodicity standard, should have some special arrangement made for them. What that special arrangement was the Prime Minister did not say. He said there would be considerable expenditure in standardising electrical supplies, but that it would not fall upon the State. The only thing they could deduce from that was that it would fall upon those who might be outside the standard chosen. In that case it would seem that a heavy expenditure would fall upon Birmingham manufacturers. Therefore, they suggested that when the Government came to consider the details of the scheme, the manufacturing and industrial interests concerned should be consulted.

The President (Councillor H. E. PARKES), in seconding the resolution, described the matter as of very grave importance to the manufacturing interests of the district. They were told that an important committee had gone very carefully into the facts and figures of this enormous electrical scheme. He had no doubt it had, but he felt that before a scheme of that magnitude was definitely decided upon, all parties interested should be placed in a position to judge as to its

chance of success by being given the basis upon which the scheme was grounded. They had had an example of high hopes of economies in the recent railway amalgamations. In 1921 Sir Eric Geddes stated in the House of Commons that by the amalgamation of the railways they expected to save 25 million pounds a year, and mention was made that there would be a possible saving of 45 million pounds in six or seven years. They were now five years from the time the statement was made, and recently the railway companies had the opportunity of claiming one-third of the savings under the amalgamation scheme; all they could claim was £1,770,000—an enormous difference. He felt that the business community ought to be in a position to examine the basis of this immensely important electrical scheme before it was placed before Parliament.—*Birmingham Post.*

Municipal Undertakings' Committee.

A meeting of the Association of Municipal Corporations to consider the Government's electricity scheme was held in London on January 29th, presided over by Sir Lewis Beard (Town Clerk of Blackburn), and, on the motion of Sir John Utting (chairman of the Finance Committee of the Liverpool Corporation), it was decided to elect three representatives of the largest municipal electricity undertakings, three representing those of medium size, and three representing the small municipal undertakings, to meet nine representatives of the Electrical Engineers' Association to consider the advice which the municipalities could tender to the Government in relation to the framing of its electricity scheme.

A further meeting of the Municipal Corporations' Association will be held to consider the report of the Committee and to decide on the advice to be given to the Government.—*Birmingham Post.*

Mr. Stanley Baldwin on Electricity Supply.

At Sunderland, last week, the Premier addressed a large meeting on various features of the Government's policy. With regard to electricity supply he said :—" I want to repeat this—that while cheaper and more abundant supplies of electricity are admirable in themselves, and indeed necessary, they will not alone restore good trade or give us industrial peace. Don't be led away by excitable people who seem to think that electricity in two or three years is going to transform the face of the country and make coal of no further use. The truth is, of course, electricity can be put to many uses, but it is a striking thing that with the growth of electricity in other countries where it has been developed more than here, it has led, or if you like been accompanied by, a growth all along the front of industry, with a growth in the use of gas and in the use of coal, and a development of industry generally.

" Expressions of doubt and fear have been heard from those who are interested in gas. There is assuredly room, not only for electricity and gas in this country, but for an enormous development of both.

The Views of Mr. Geo. Wilkinson, M.I.E.E.

" No national supply of electricity, even if supplied free of charge, can revive trade or recreate general prosperity without ' the will to work ' on the part of labour and the creation of a more amicable relationship between employers and employed. That is the first essential. At the present moment it seems to be taken for granted as an accepted gospel that the establishment of a number of super-stations supplying extra-high-pressure three-phase energy, and linked together by trunk mains embracing the whole country, is the certain way to provide cheap electricity everywhere. Unfortunately such high-pressure trunk mains involve enormous capital outlay and considerable permanent charges in maintenance, while transmission through them of much power for long distances can only be achieved by a heavy waste of energy.

" Well-designed electric generating stations of from 6,000 to 10,000 kW capacity located within the area where the supply is required are, in comparatively isolated towns and residential areas, nearly as efficient as the super-station and certainly more efficient than the super-station plus the long and costly extra-high-pressure trunk transmission cables.

" To supply with efficiency and economy the electrical requirements of a whole town to the saturation point through two or three trunk mains from super-stations 25 or 30 miles away is a proposition which has found no solution yet. For many such areas—which are found in all parts of the country—a modern local generating station in combination with that cheapest of all power feeders, a coal train on a good railway line, need fear no competition in efficiency from the super-power stations. Again, there are large areas that can be more cheaply, simply, and effectively supplied by means of the single-phase system. Success or non-success is often contingent on the cost of distribution, and for simplicity, reliability, and good pressure regulation there is nothing better or more effective for non-industrial areas than the single-phase system, and it is worthy of greater attention than it is apparently receiving at present. . . . It is to be hoped that legislation will not be introduced that will lay a cast-iron system down for the whole country; what is particularly applicable to one part of the country may be distinctly retrograde in another. The futility of such methods is shown to-day in the coal industry, where uniformity of method and practice can never give general satisfaction, or restore the industry to its former prosperity. This is possible in one way only, and that is by adopting such methods and practice in each locality as are best fitted to meet the local conditions. The same truths hold good in the electricity supply industry."—*Manchester Guardian.*

Mr. W. B. Woodhouse, M.I.E.E., on the Scheme.

" Mr. Baldwin says that in Chicago the consumption per head is 1,000 units per annum, whereas the average in England is 100. It is interesting to note that in Manchester, where consumption reaches 200 units per head, the price of electricity for domestic purposes is lower than it is in Chicago. The explanation is that we have cheap alternatives to electricity. We have cheap coal and all that that means, so that it is unwise to assume that the amount of use depends entirely on the price.

" A good deal has been said about rural supply, and as to what has been done in other countries. It has been found in all countries that the cost of generation is a negligible proportion of the total cost for providing a supply of electricity in rural districts, and to expend very large sums of money on transmission mains to supply farmers may not prove so economical as, for example, the use of individual oil engines on the various farms. But as public supply is developed for other uses, it becomes possible economically to supply the rural districts. No gain seems likely to arise by forcing this development.

" The Premier's remarks on frequency are of interest, as in Birmingham a frequency of 25 cycles is in use, whereas the standard for the country has been fixed at 50 cycles. It is understood that the Birmingham Corporation has investigated this question, and has decided that no gain is likely to accrue by a change of frequency. In New York two frequencies are in use, and quite recently a very large power station has been laid down to supply a still further amount of electricity at 25 cycles. It will be seen, therefore, that even in America a case has not been made out for a single standard.

" The amount of interchange of power between one coalfield and another is not likely to be great, and so, if different frequencies are in use in different coalfields the disadvantages may not be great enough to justify the change. It is, therefore, entirely a matter of balancing the costs against the savings; and it should be possible to ascertain in each area what is in the best interest of the public. If frequencies are to be changed without delay to one standard, a very large expenditure will be involved; who is to bear it?

" What the industry most wants in the public interest is a continuation on the present lines of development with an assurance to all connected with the industry of freedom from disturbance if their duties are carried out efficiently. The frequent alteration of legislation affecting the electricity supply industry has caused much delay, and in many parts of the country distribution schemes which would find a considerable amount of employment, and which existing undertakers are prepared to carry out, are being held up pending the publication of the Government's proposals.

" The same thing happened before the passing of the last two Acts in 1919 and 1922, and but for this I think the development of electricity supply in this country would have been substantially more advanced than it is at present."

" Without any further legislation the progress of concentration of generation in large stations is already proceeding rapidly, but there must be many parts of the country where a cheaper supply could be given to the consumer by putting down a small local station than by erecting costly transmission mains. Inter-connection of generating stations presents advantages within limits decided by the balance of the savings made and the extra costs incurred, and, generally speaking, there does not appear to be any advantage in inter-connected power stations in different coalfields. Each case must be judged on its merits."—*Yorkshire Post.*

Sir Felix Pole and Railway Electrification.

" A committee of Great Western experts has for about three years been engaged in surveying sections of railway which appeared to offer possibilities for electrification. While many of these sections appeared on the surface to be suitable for the introduction of electric traction, it was in every instance found, on going more closely into details, that no case could be made out that would, under existing conditions, justify the capital expenditure involved.

" But we have not left the matter at that. Just under a year ago the board deputed Sir Philip Dawson to prepare a scheme for electrifying a section of main line, to be not less than about 120 miles in length. He has not, however, yet produced a scheme."

Sir Felix desired to make it clear that the root of the matter was economic. The governing factor, he emphasised, was the cost of electrical power, irrespective of the ownership of the source of supply. " If," he said, " the railways could obtain their power at a very much lower cost than at present, and if the price per unit could definitely be guaranteed over a reasonably long period, that would, of course, put an entirely different complexion on the whole matter."—*Financial News.*

Traffic Loud-speakers.—In order to assist passengers who are unaccustomed to underground travel, the Underground Railway Company is said to be contemplating the use of loud-speakers at some of the principal stations. It is believed that much of the delay caused by the inspection of sign posts might be avoided in this way, as one man could direct passengers to their proper routes on the " public address " system.

Legal.

Standard Telephones & Cables, Ltd., v. Freeman.

IN the Chancery Division on January 26th Mr. Justice Tomlin gave judgment in an action by Standard Telephones & Cables, Ltd. (formerly the Western Electric Co.) against Mrs. Freeman, of the Crown Works, Poets Road, Newington Green, for an injunction restraining infringement of its patent for improvements in self-supporting electrical coils. Defendant denied that she had infringed the patent.

It was stated in the specification that the invention had for its object the provision of an inductance coil in which the distributed capacity was minimised, thus making the coil very valuable for radio work.

His LORDSHIP, after hearing the evidence, said that he had to solve the problem of the difference, if any, between the plaintiffs' and the defendant's coils. The defendant declared that there was so much divergence between them that nobody could say that they were both made according to the plaintiffs' specification. He could not agree with that, and it was clear to him that the defendant's coil was constructed to give literal effect to the language of the plaintiffs' specification, being wound in the manner there set out. He therefore granted the plaintiffs the injunction asked for, an order for the delivery up of infringing articles, with costs, and an inquiry as to damages, the costs of this to be reserved.

The Reduction of Vickers's Capital.

IN the Chancery Division on January 26th, Mr. Justice Eve approved the reduction of the ordinary share capital of Vickers, Ltd., from £12,500,000 to £4,166,166.

Telephone Manufacturing Co., Ltd., v. Soutter & Sons, Ltd.

SIR EDWARD POLLOCK, the Official Referee, on January 25th concluded the hearing of the case of the Telephone Manufacturing Co., Ltd., against Messrs. Soutter & Sons, Ltd., Hockley, Birmingham, the case having been referred to the Official Referee by the order of a judge of the King's Bench Division (*vide* ELECTRICAL REVIEW, January 15th, p. 107).

The plaintiffs brought the action alleging that the defendants had broken their contract by which they (plaintiffs) were appointed sole agents for the sale of "Soutterware" for four years, and that they had expended large sums in advertising and in the organisation which they had set up and perfected, but owing to the delay by the defendants in carrying out orders they had had to repudiate the contract for which they claimed damages.

Defendants denied that, and counter-claimed for damages against the plaintiffs upon the ground that the latter had improperly repudiated the contract.

In the result the case was settled on the terms that the plaintiffs agreed to pay the defendants £17,000.

False Pretences Charge.

AT Old Street Police Court, on January 26th, Charles Frederick Kidby (29), gramophone dealer, of Brixton, and Alfred Sidney Taylor (42), engineer's fitter, of Stoke Newington, were charged on remand with being concerned together in knowingly obtaining a quantity of wireless goods, value £44 8s. 4d., from Mr. E. E Rooke, with intend to cheat and defraud (*vide* ELECTRICAL REVIEW, January 15th, p. 97, and January 29th, p. 174). Det.-Sergt. Edwards said that Kidby's house was searched, and there were found 152 statements of accounts from various firms from whom defendants had obtained goods valued at £4,000. Those statements had been compared with such books as the defendants had kept, and they found that 38 had been paid, leaving a balance of over £3,000. Defendants' practice had been, chiefly, to get goods to the value of between £20 and £100, and establish credit by paying amounts on account. All the orders sent out by the firm had been signed by Taylor.

The defendants pleaded guilty to seven charges. Taylor was sentenced to 12 months' imprisonment and Kidby to nine months' imprisonment.

Bingley District Council v. Barber.

AT Keighley County Court recently the Bingley District Council claimed £100 for electricity supplied to Richard Barber, a worsted spinner. Mr. H. O. HILARY, clerk of the Bingley Council, representing that authority, said that the current was supplied to Clyde Street Mills, Bingley, under agreement between the Council and defendant, but the point at dispute was whether the supply was to defendant or to the firm of R. Barber & Co., Ltd., which had taken over the defendant's business. Giving evidence, the defendant said he instructed a clerk in the Bingley Council's accountant's office to alter the name for the accounts to that of the company, and he paid the account by cheques from the firm's accounts. The company's affairs were now in the hands of a receiver. Mr. HILARY said that the clerk had been given no authority to make such alteration, and the agreement with the defendant personally had never been altered.

His Honour Judge MCCLEARY accepted the evidence of the defendant as to the interview with a clerk at the Council's offices, and said he was satisfied that what was done by the clerk was adopted by his employers. The Council had also sought to make the company liable for this bill, and from the time of the interview had looked to the company for payment. Now that the likelihood of payment from the company seemed remote it could not seek to make the defendant liable, and the claim would be dismissed, with costs.

Dublin and Lucan Electric Railway Co.

IN the High Court at Dublin, before Mr. Justice Johnston, recently, Mr. Moloney, B.L., applied on behalf of Mr. John Foxall, of Anglesea Street, Dublin, trustee for the debenture holders of the Dublin and Lucan Electric Railway Co., for an order for the winding-up of the company. A representative of the company said that the winding-up petition had been before the Court on previous occasions, and had been adjourned to see if there was any possibility of the line being taken over.

Mr. MOLONEY said that a provisional liquidator was appointed and certain negotiations had been going on for the sale of the undertaking.

Mr. JUSTICE JOHNSTON said he was satisfied and accordingly he would make an order for the winding up of the company.

Mr. MOLONEY said that his Lordship had given the provisional liquidator liberty to carry on negotiations for the sale of the undertaking as a going concern, and he would like that continued. It was probable that the negotiations would be closed at an early date.

Mr. JUSTICE JOHNSTON agreed to continue the power to the provisional liquidator to carry on the negotiations for the sale, and to give him liberty to carry on the existing contracts for the carriage of mails and newspapers, and for electric lighting. He appointed the provisional liquidator as official liquidator, and made the usual order for costs.

Beet-Sugar Company Prosecuted.

THE *Nottingham Evening Post* reports that on January 27th the Anglo-Scottish Beet Sugar Corporation, Ltd., appeared at the instance of the Director of Public Prosecutions, through the Chief Inspector of Factories, before the Nottingham magistrates. The charge against the company was that it had neglected to efficiently protect a brass collar conductor forming part of the screw-cap lamp, in consequence of which an employé, James A. Glover, was killed.

Mr. B. G. SAYWELL, for the prosecution, said that the company generated its own power and employed electricians. On October 29th last Glover and another man were fitting up an electric furnace, and were using high-power pendant lamps suspended from the roof, and in some cases secured by string to the girders. The lamps were of the screw cap pattern, and one side of the lamp filament was soldered to the cap, making it "live." Glover climbed to the roof to alter the position of one of the lamps; his mate heard him shout and saw him with the lamp in one hand and his arm over a girder. The man knocked the lamp out of Glover's hand, and Glover was brought down in an unconscious condition and died soon afterwards. If the lamp had been shrouded Glover would not have received a shock.

JOHN BETT, Glover's companion at the time of the fatal accident, corroborated these statements, and said that the current was 230 V a.c. The electricians, he said, had not been told not to touch the lamps. Medical evidence was given to the effect that Glover died from electrical shock, and a factory inspector said that the lampholders were dangerous. For the defence, Mr. Berryman contended that the electricians should have been asked to move the light. The premises were in course of construction, and therefore were not a "factory" within the meaning of the Act. Mr. Saywell contended that as manual labour was being performed there the premises were a factory.

The Court reserved its decision until advice had been taken upon the legal point raised.

Lapish v. Braithwaite.

This case came before the Lord Chancellor, and Lords Atkinson, Buckmaster, Carson and Blanesburgh in the House of Lords, on January 29th, upon the appeal of the plaintiff from a decision of the Court of Appeal reversing a judgment of Mr. Justice Bailhache. The question at issue was whether the defendant could remain a member of the Leeds City Council while firms with which he was connected had contracts with the Council. Mr. Justice Bailhache held that the defendant was liable to penalties, and awarded judgment for the plaintiff for £10.

The appeal to the House of Lords was dismissed. In giving their Lordships' reasons for this the Lord Chancellor said that under the Municipal Corporations Act, 1882, the defendant was not disqualified to sit and vote on the Council by reason of his being a shareholder in companies which had transactions with the Council. Nor was he disqualified on account of his being managing director of any of those companies. He was then a servant of the company with a fixed salary. If, however, he was remunerated by a percentage or commission on the profits of his company, different considerations would arise. In the present case the defendant was not so remunerated. According to the report of the case in *The Times*, the Lord Chancellor concluded:—"There are now many companies in which most or substantially all of the shares are held by one man, who may also be the principal or governing director of the

company, so that the business is his business in all but name; and if by reason of the exception in Section 12 (2) such a man can remain a member of a municipal body with which his company is in contractual relations, the Section will lose much of its force and value. It is not for your Lordships to suggest the manner in which this danger should be met, but it appears to me that the Legislature might well consider whether the Section should not be strengthened either by extending the disqualification to persons who hold a substantial proportion of the shares in a contracting company or in some other way."

The other members of the Court concurred.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

An Electric Vehicle Association.

Mr. Raymond J. Mitchell's reference to my letter is welcome as coming from one whose articles under "R. J. M." I have always read with interest and appreciation, therefore I pardon his inadvertent humorous allusions. His letter is welcome in another sense, in that he has recently joined the staff of one of the well-known manufacturers of electric vehicles—subsequently joining the reorganised Electric Vehicle Committee in company with the general manager of the same firm, of whose activities we have heard so much of late.

The informal meeting will have to consider among other matters:—

1. Whether the proposed new association would be redundant, or whether the several interests—particularly those of users of electrics—would be better served by such an association devoted exclusively to the one purpose.
2. Its relationship and co-operation with other bodies and committees to avoid overlapping; and its representation on the Council of the E.D.A.

It is conceivable that the influence of such an association as is proposed would be more widely beneficial than deliberations in the restricted confines of a committee, inasmuch as it would afford scope for all to ventilate their views and difficulties on a common platform, especially the users and prospective users of all types of vehicle. Probably we should then hear less of "electrics" being abandoned in favour of other means of propulsion; as contributory causes leading up to such a result would be dealt with in the initial stages, the association would investigate impartially and "nurse" the user in each instance.

The main obstacles to progress are fairly obvious, but the lack of conveniently located charging stations is one of the first that the proposed association should seriously tackle. Each of its members should be furnished with a complete list of public and private charging stations, the proposed association negotiating where necessary with those electricity supply authorities which have not yet fully appreciated the mutual benefits arising from the charging of vehicle batteries at times other than peak loads; and, failing satisfaction in that direction, to adopt other measures to assist users who are members in obtaining energy at suitable locations at a reasonably low cost.

In view of the standardising of a.c. working throughout the country we now have to consider the cost of conversion in every instance, as compared with generating d.c. by gas or oil prime movers. In cases where the electricity supply authority's charges are unreasonable, it is probable that users with private d.c. supply plant may be pleased to render assistance to their brother members. Electricity supply authorities can hardly object to this alternative if they have considered the business as unremunerative to themselves at a reasonable price; although the vehicle may be a consumer in more than one supply area!

As regards the sales of vehicles, much could be advanced by extending cordial invitations to prospective users to attend special propaganda meetings of the proposed association, where suitable papers for the occasion would be read and discussed, dealing with all trade and private uses.

Also, there are influential persons in other walks of life, who are closely studying the health and welfare of citizens and the amenities of city streets and traffic conditions. Such persons would be welcomed and would most probably support and attend the meetings of such an association, which would have a direct bearing on the purifying of the atmosphere of our towns and cities; whereas they might refrain from attending a technical committee.

Demonstrations and exhibitions could also be arranged.

As regards representation on the E.D.A., Mr. Beauchamp's admirable management of which is beyond all question, it should be remembered that several associations are already represented on its Council, and I respectfully submit that the position of electric vehicles would be strengthened by the inauguration of a definite association devoted exclusively to electric vehicles, which association would then be placed on an equal footing with the other associations represented on the Council of the E.D.A. With this in view, I had already approached Mr. Beauchamp for the support of E.D.A., but he could hardly be expected to devote any more time to the proposed association than to any other of the definite bodies and associations already represented on the Council, whose interests he has equally to study.

An electric vehicle association, I venture to suggest, would carry more weight when negotiating with electricity supply authorities direct or through E.D.A., which represents many supply stations—with a view to securing reasonably low-priced energy for electrics. The proposed association would assist the man who purchases an electric automobile to retain it, and not leave him to dispose of it owing to lack of charging facilities.

In conclusion, I welcomed Mr. Mitchell's letter as affording me the opportunity of assuring all those interested that I have not made my suggestion "on the spur of the moment," having watched the progress of electric vehicles during the whole of my 25 years' career in the hard fields of practical experience in electricity supply and its use in several aspects, in my professional capacity having had to face the difficulties of high initial cost of vehicles and lack of convenient charging stations for prospective users.

J. C. Elvy.

London, *January 23rd*, 1926.

The Cost of Living in Madras.

In your issue of December 4th, 1925, you print a statement from a gentleman in Bombay, giving the cost of living in that city. Below, I give the approximate cost of living per month in Madras, which is reputed to be cheaper than Bombay.

1.—House rent (decent bungalow)	Rs.125/-	to	Rs.200/-
2.—Living in boarding house, chummery, or as paying guest in private house	120/-		
3.—Boy (servant)	20/-		
4.—Dhoby (washerman)	8/-		
5.—Ayah	20/-		
6.—Cook	20/-		
7.—Tarmic catch (waterwoman) ...	8/-		
8.—Gardener	10/-	to	12/-
9.—Motor-cycle and side-car ...	25/-	to	30/-
10.—Motor-car (including chauffeur's wages)	150/-		

A bachelor would require 2, 3 and 4. A married man with his own establishment, 1, 3, 4, 5, 6, 7 and 8; in this case the dhoby would probably be Rs.12/- for man and wife, plus Rs.3/- for each child. If he preferred to be a paying guest, 2 (full charge each for self and wife, and probably half for each child) 3, 4 and 5. If he visits the club and goes to one or two entertainments during the month, a bachelor will want at least another Rs.150/-, a married man Rs.225/-, and to this will have to be added the cost of clothes for his wife and children. Madras is a place of distances, and it is necessary to have a conveyance of some kind. A bachelor might manage with an ordinary bicycle, but a married man will require a motor-cycle and side-car, or a motor-car. Chauffeur's wages are from Rs.35/- to Rs.60/- per month.

The Rs.150/- extra includes the cost of running a motor-cycle and side-car.

A Twenty-five-Year Resident of Madras.

Madras, *January 11th*, 1926.

[We are indebted to our correspondent for this interesting information.—EDS. ELEC. REV.]

The Indian Electricity Acts.

May I claim your indulgence, as the only practical means of reaching many electrical engineers in India, not, indeed, for a free advertisement, but for an opportunity of appearing in a white sheet!

In my book, "The Law Relating to Electrical Energy in India," Second Edition (Thacker Spink & Co., Calcutta) there are several mistakes in the text of the schedule, to which my attention has only just been drawn. Into the reasons for these errors I need not enter, but the necessary corrections will be found in your advertisement sheets on February 5th, and I would ask all possessors of the book to correct their copies.

J. W. Meares.

Guildford, *January 29th*, 1926.

Electrical Apparatus on Hire-purchase.

In your issue of January 22nd, Mr. L. L. Robinson suggests that the drawback to the development of electricity in his area is the cost of installation and apparatus, and he suggests a hiring scheme.

This is an excellent idea, but contractors should take the orders and carry them out, and the supply undertaking should provide the financial side of the hiring scheme, which would work better on a hire-purchase basis, and not on simple hire. Contractors could carry out this scheme without the help of the undertaking, but are handicapped in the event of the customer lapsing in payments; their only remedy is to take legal action, which I doubt would produce any good result.

The usual alternative in hire-purchase contracts is the removal of hired goods from premises, but I have an idea that most landlords have a clause in their agreements that fixtures attached to the premises become the property of the landlord.

If the local undertakers officially financed a hiring scheme, the obvious remedy for non-payment of instalments would be disconnection of supply, and this would have the required effect in the majority of cases.

A similar scheme has been working for some time in the motor-car trade, the financing body charging approximately 4 per cent. for the accommodation, and I see no reason why the electrical installation business cannot be run on the same line.

Hy. Freedman, N.R.E.I.C.,
Henfrey Electrical Installations.

London, *January 28th* 1926.

The Italian Electrical Industry.

I have read with great astonishment the article on the Italian electrical industry in No. 2,510, of January 1st, 1926, of your paper.

The grievous assertions contained in that article are completely groundless, and evidence in your correspondent an absolute lack of reflection and prudence. They also evidence in the direction of the paper a deplorable facility in accepting and publishing upon a great Italian industry and the whole praiseworthy body of our engineers some gratuitously offensive assertions.

We regard it as a debt of honour on the part of your correspondent to declare his name or to disavow his article. We take it as your duty to denounce to us the name of your correspondent if he rejects our demands.

I deem it necessary to address you this letter, in my quality of Chairman of the Associazione Nazionale Industrie Elettriche (National Association of Electrical Industries), which represents more than 2.5 milliards of capital stock, with a yearly output of energy of about 3.5 milliards kWh.

Giacinto Motta.

Milan, *January 22nd*, 1926.

[We have received a similar communication from Sig. Ing. Prof. Giuseppe Sartori, President-General of the Italian Electrotechnical Association, Milan, and a telegram from Sig. Prof. G. Ponti, president of the Association Operating Electrical Undertakings, Turin, to the same effect. We regret that the susceptibilities of our Italian friends and confrères have been wounded by the comments of our correspondent in his article. So far as concerns ourselves, we may say that the passages to which they take exception were carefully considered, and were passed as fair comment upon a matter of public importance; they were much milder than similar references to the failure of the Gleno dam which appeared in the *Engineer* of June 12th, 1925, and we may point out that the construction of dams is a civil engineering question, for which electrical engineers, whether in Italy or elsewhere, are not usually held responsible. We fail to see, therefore, why the Italian electrical associations should feel aggrieved by our references to hydraulic engineering.

We have communicated with our correspondent in Italy, and have ascertained that he had no intention whatever to cast any unfavourable reflection upon the ability or the general success of the large and highly-esteemed body of engineers engaged in the Italian electrical industry. Our correspondent's references were directed to the fact that, in times past, when the industry was still young, mistakes had been made in the construction of certain dams and reservoirs; and, far from reflecting upon the general conduct of the electrical industry, he pointed out that "the industry in Italy is showing signs of real progress." Attention was drawn to the unsuitable design, and eventual collapse, of the Gleno reservoir, in December, 1923, with a view to any similarly unfortunate collapse being obviated. Our correspondent particularly indicated that the Gleno accident was due to the fact that the dam had been built and put into use without the permission of the Ministry of Public Works, and, therefore, could not be regarded as an example of such constructions. In the "Memoria Tecnica—La Diga del Gleno"—drawn up and signed by the distinguished Italian engineers, Sigg. Ing. Prof. Mario Baroni; Luigi Kambo; Urbano Margoli, and Ugo Granzotto (dated April 15th, 1925), the authors clearly showed by inference that there had been marked progressive fissuring of the rock in the Gleno gorge, while, according to the reports issued by Sigg. Prof. Paolo Vinassa de Regny and Prof. Mario Felici, the type of the dam, apart from its actual form, "was ill-chosen." The object of our correspondent in Italy was to impress upon our readers the necessity of learning from experience, and in so doing he expressed the hope—and, indeed, the belief—that future hydroelectric dams built in Italy would be free from any such defects. There are other countries, including our own—as witness the disastrous accident that happened to the Dolgarrog Dam in North Carnarvonshire last November—where dams have burst; but no general condemnation of the engineering profession has either been expressed or considered in relation to such misfortunes. Nor was any such deduction to be drawn from the article by our correspondent in Italy regarding the Gleno accident.

We cherish too high an esteem for the achievements of the Italian nation, whether in art, science, or engineering, to be willing to cast upon it any aspersion, and we are glad to learn from Signor Sartori that out of 95 large reservoirs in Italy with high dams, only one (the Gleno) has failed.—EDS. ELEC. REV.]

High-pressure Cables.

In the debate on Capt. P. Dunsheath's recent I.E.E. paper, Mr. Emanueli, the engineer of the Pirelli Cable Co., of Milan, mentioned a cable working at 130,000 volts, alternating, which they have had in successful operation for some 18 months.

Questions of electrical transmission are likely to be prominent subjects for discussion during the next few months in this country, in view of the proposals which will be before Parliament. It may, therefore, be of interest to say that I have recently been in Milan, and while I was there Mr. Emanueli was good enough to spend nearly a whole day discussing dielectric principles as elucidated by work extending over many years in their fine laboratories, and in showing me how they have endeavoured to embody the principles in the design and construction of the above-mentioned cable.

Not only has a considerable experimental length of the cable been in operation as above stated, but some miles are in course of construction for two American power companies. The cable is, therefore, not merely an experimental *tour de force* for exhibition and advertising purposes—it is a serious piece of work already at the commercial stage.

Although it would be interesting, I do not feel at liberty to describe in detail what I saw and heard, but must leave that to the discretion of the Pirelli Co. itself. I may say, however, that the principles on which the design is based appear to me to be entirely in the right direction for high voltages and heavy transmission. As regards the embodiment of these principles, I would also like to express my admiration for the boldness, inventiveness, and attention to detail, which mark the construction of the cable itself, and the methods which have been worked out for its installation and operation. These have resulted in what I am confident will prove an important development in cable practice.

Cable of this type should place a new power in the hands of engineers who have to deal with distribution problems in large areas that are at all thickly settled.

G. L. Addenbrooke.

London, *February 1st*, 1926.

[An interesting paper by Mr. Emanueli is reproduced elsewhere in this issue.—EDS. ELEC. REV.]

Several letters have been received, too late for insertion in this issue.—EDS. ELEC. REV.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

"Electrical Review" Advertisement Competition.—We hope to be able to announce the result of our Advertisement Competition in the next issue of the ELECTRICAL REVIEW.

Change of Address.—MR. A. DE TURCKHEIM, the secretary, announces the removal of the following to 58, Abbey House, Victoria Street, Westminster, S.W.1, as from to-day, Friday, February 5th:—

The Tramways and Light Railways Association.
The Incorporated Association of Electric Power Companies.
The National Joint Industrial Council for the Electricity Supply Industry.

The telephone number in each case is: "Victoria 2110."

The British Industries Fair.—It is stated that there will be a special radio apparatus section at the London branch of the Fair, and that no fewer than 33 firms have booked space for their exhibits.

The Shannon Scheme Dispute Ended.—Official intimation has now been made by the Irish Labour Party of the "calling off" of the strike and boycott on the Shannon hydro-electric scheme in the Limerick area. At a recent meeting of the Athlone Urban Council, discussing the question of providing new retorts at the gasworks, the chairman remarked that the Shannon scheme would soon be completed and that there would then be no need for the retorts. A Labour member said that the Shannon scheme would not be completed for 10 years. The Council decided to incur the cost of new retorts.

An Industrial Lighting Chart.—For the use of electric lighting contractors and their customers, the Benjamin Electric, Ltd., has issued a chart indicating the correct types of fittings for use in the lighting of shops, factories, offices, &c. It is mounted on linen and measures about 18 in. by 2 ft.

British Interests in China.—A committee has been formed to study the political situation in China in the interests of British trade. Lord Southborough is the chairman, and the members are as follows:—Messrs. D. Landale and G. W. Swire (China Association); Sir H. Cunliffe-Owen and Col. O. C. Armstrong, D.S.O. (F.B.I.); Messrs. F. Anderson and S. Dodwell (London Chamber of Commerce); Mr. H. H. Holt (Chamber of Shipping); Sir N. J. Stabb (Hongkong and Shanghai Banking Corporation); Mr. L. N. Keefe and Lieut.-Gen. Sir G. Macdonogh (China Advisory Committee); Sir R. Waley Cohen (Asiatic Petroleum Co., Ltd.); and Major W. S. Nathan (Peking Syndicate). The secretary is Mr. W. V. Jenkins, of the Far Eastern section of the F.B.I. The Committee has offered its services to the Foreign Office, and Sir Austen Chamberlain states that the Government will be glad to avail itself of the offer.

Electric Water Heating in Ships.—Sir W. G. Armstrong, Whitworth & Co., Ltd., who recently placed an order with Messrs. Bastian & Allen for "Bastian" storage geysers for water-heating equipment in two ships being built at Walker Yard, Newcastle-on-Tyne, have now placed with the firm a repeat order for storage geysers for the water-heating equipment for two further ships.

A New Super-Power-Station for London.—The proposal of the North Metropolitan Electric Supply Co., to establish a power station on an existing site at Brimsdown, near Enfield, has now taken definite shape, and the contracts for the first section of the station of 40,000-kW capacity have been placed with the object of completing and operating the plant in a period of twelve months. The project first came under consideration in September last, when Capt. J. M. Donaldson, the chief engineer, invited two or three leading engineering concerns to discuss various proposals with him; this was followed by a request to draw up alternative schemes and to prepare estimates for his consideration. Regular conferences have been held, and throughout the negotiations Capt. Donaldson has personally supervised the engineering; the plant now in course of manufacture will conform to the most modern practice of power generation. As main contractor the Foundation Co., Ltd., has been selected, with International Combustion, Limited, as principal sub-contractor. The latter company has been awarded the whole of the contract covering steam generation and transmission, and the "Lopulco" system of powdered fuel firing is to be installed. Five boilers, each of 10,100 square feet heating surface, have been ordered, and are to be manufactured by Messrs. Babcock & Wilcox. Each of these boilers will be equipped with the "Lopulco" patent water screens and "Murray Usco" fin furnaces, which will increase the total heating surface of each boiler to 11,000 square feet. International Combustion, Ltd., has placed orders with Messrs. Howden's for the air preheating equipment, and for economisers and superheaters of the Foster type the contract has been placed with the Power Specialty Co. The plant will include the latest design of pulverising mills, each of fifteen tons per hour capacity, which with the rest of the equipment will be manufactured by International Combustion, Limited, at its own works at Barrow and Derby. This station when complete will be the largest in the London area operating entirely with pulverised fuel, and the results will be awaited with much interest.

Norwegian Ship Equipment.—A new undertaking for the construction of ship radio telegraph and telephone installations has been formed in Oslo by Mr. Lehmkukl, with Mr. Paul Ydalus, who was for a long time connected with the works of the French S.F.R. (Société Francaise Radio), as technical manager. The new firm has entered into an agreement with the French company for the use of its patents and types.

Social Events.—MESSRS. FERGUSON, PAILIN, LTD., held their annual staff party and dance at the firm's Social Institute Rooms on Saturday, January 23rd. The directors invited all the members of the staff to be present and to bring their friends. Two of the directors, Messrs. S. Ferguson and G. Pailin, presided. An original farcical comedy entitled "Broadcasting" was given by members of the staff. The cast was as follows:—Station director, and producer, Mr. George Pailin; Chief Engineer, Mr. R. Connard; Announcer, Mr. R. B. Willcock; Aunty Pon, Mr. J. Hammons; Uncle Wally, Mr. W. Grimshaw; Call Boy, Mr. J. Howarth. The News Bulletin, Children's Corner, and "Eve's Review," lent themselves admirably to burlesque, and much amusement was created as individual staff members were introduced in humorous, but good-natured terms. This item was followed by an entertainment introducing the "F.P. Follies," who sang popular choruses, accompanied by the F.P. Orchestra. Dancing occupied the remainder of the evening, in the course of which a huge Christmas cracker nearly 20 ft. long was opened, and a large number of toy balloons emerged from its interior.

The Greater London Division of the Electricity Supply Commercial Association held a successful dance at Cannon Street Hotel on January 26th. Over 400 members and friends were present and everybody gallantly danced through the evening to the last bar of the last waltz despite the mild weather. No doubt the excellence of the music provided by the orchestra was a determining factor. Innumerable novelties were distributed, and the social spirit displayed was a marked feature. The secretary, Mr. G. R. Smith, and those who assisted him in organising the event are to be congratulated for the excellent arrangements made, of which the catering was not the least appreciated.

Lead.—Messrs. James Forster & Co. state:—"According to Metal Exchange Statistics, the apparent consumption of lead in the U.K. during 1925 was 253,459 tons, an increase of about 33,000 tons over 1924, as against an increase of 30,000 tons in 1924 over 1923. Stocks of lead, however, on December 31st, 1925, are given as 5 tons, whereas various authorities estimate them at from 8,000 to 12,000 tons. Taking the average figure, this would reduce the increased consumption during 1925 to 23,000 tons over 1924, against an increased consumption of 30,000 tons in 1924 over 1923."

Local Exhibition.—ANNFIELD PLAIN.—The Urban District Council is arranging to hold an exhibition in three of the houses which have been built under its auspices. These will have only one coal fire and will be equipped with an electric cooker, a calorifier for bath and kitchen use, and a wash-boiler. As the exhibition will coincide with the introduction of a special domestic tariff (6s. per month plus 1d. per kWh, provided that 4 kW of appliances, independent of lighting, are installed) good results are anticipated.

Extension of Southampton Docks.—At a recent meeting of the Southampton Harbour Board, Major Szlumper, assistant manager of the Southern Railway, said that his company proposed a radical alteration in the lay-out of the proposed new docks. Under the scheme the company would be able to increase the quayage from 10,000 to 17,000 sq. ft. A start would be made upon the work as soon as the latest proposals had been considered. A description of the electrical equipment of the docks was published in our issue of September 18th (p. 471), and it appears probable that a great deal of further plant will soon be required.

Trade Announcements.—MR. G. ELLAM has removed from 69, Corporation Street, to 37, Cannon Street, Manchester, and has been appointed selling agent for Lancashire, Yorkshire, and North Wales for the "Draka" wires and cables produced by Electric Cables, Ltd.

The telephone number of MESSRS. R. O'BRIEN & Co., 66, Mosley Street, Manchester, has been changed to "Central 6486" (3 lines).

MR. ALAN WRIGHT, Sentinel House, Southampton Row, W.C.1, has been appointed sole sales representative for Great Britain, Ireland, and export for Hazemeyer switchgear. He has sent us a pamphlet dealing with star-delta starters.

With reference to an announcement published in this column last week, Mr. DRYDEN, who has purchased the business of L. Weekes, Ltd., from the liquidator and receiver, has registered a new company under the title "L. Weekes (Luton), Ltd" (see our "New Companies" section to-day), which will be carried on with Mr. L. Weekes acting in the capacity of managing director.

We are informed that the "INO" GUARANTEED LAMP CO., LTD., of 35, Aldermanbury, London, E.C.2, is preparing to open a factory in Southend-on-Sea for the manufacture of electric lamps and other electrical appliances.

The address of PHILIPS LAMPS, LTD., is now 145, Charing Cross Road, W.C.2. Telephone: Regent 7731; telegrams, "Phillamps, Westcent, London."

THE ELECTRO-MECHANICAL SUPPLIES, LTD., of Coventry, is moving on February 9th to 44, Bayley Lane, Coventry.

MESSRS. E. P. ALLAM & Co., LTD., 107-109,, Gray's Inn Road, W.C.1, have been appointed sole agents for London and the South of England for Messrs. Wrights Motors, Ltd., of Halifax, for the sale of d.c. and a.c. electric motors and dynamos, of which they will hold a stock.

Catalogues and Lists.—THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Square, S.W.—A February calendar-blotter, illustrating the contruction of a new open-type protected boiling plate.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.—A folder containing illustrated details and prices of "X-ray" reflectors for shop-window lighting; also an illustrated folder dealing with the lighting of Peterborough Cathedral.

THE YORKSHIRE COPPER WORKS, LTD., Leeds.—A pamphlet advertising copper tubes for hot and cold water.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—A comprehensive catalogue of electrical supplies, including switch- and fuse-gear, cables, insulators, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for January; also a mailing card advertising the company's conduit fittings and accessories.

TOK SWITCHES, LTD., Granville House, Arundel Street, W.C.2.—A blotter announcing the number of the company's stand at the forthcoming British Industries Fair, Birmingham.

MESSRS. RUSTON & HORNSBY, LTD., Lincoln.—Publication No. 4,439, containing a short history of the company and illustrations of its products.

Bankruptcy Proceedings.—W. G. CONWAY (trading as "Listron"), 88-90, Chancery Lane, W.C., radio component dealer.—The public examination of this debtor was held on January 27th before Mr. Registrar Coldridge, at the London Bankruptcy Court. He failed in November with liabilities £607, against assets valued at £313. In the course of his evidence the debtor stated that, having previously traded as a chemical merchant, he started a wireless business in November, 1924, and carried it on with success until March, 1925. In that month he entered into an arrangement with a firm to supply him with a bulk crystal, which he was to pack as "Listron" crystal, and re-deliver to them on agreed terms.

In order to carry through the arrangement, witness ordered a considerable quantity of boxes and increased his advertising, but the firm subsequently declined to take delivery of a quantity of the crystals. "Listron, Ltd.," was formed in June last to acquire his business as a going concern, but the company never functioned. He attributed his failure and insolvency to the slump in trade since March, 1925; to the failure of the customer to take delivery of the crystals; and to heavy advertising charges. The examination was concluded. The following are the principal creditors:—

	£		£
L. Harforth & Co.	46	Iliffe & Son	99
Midland Bank	46	Wireless Trader, Ltd.	34
H. Slade, Ltd.	34	Westminster Advertising Service	74
Warrilows, Ltd.	44	Wm. Sessions, Ltd.	24
Boxfoldia, Ltd.	36		

E. P. HIGGINS (Western Union Wireless Co.), 99, Regent Street, W.—Trustee, Mr. E. Parke, Official Receiver, Carey Street, W.C., released January 18th.

G. BONNET, electrical contractor, &c., 2A, Camden Road, N.W.—The first meeting of creditors was held on January 26th at the London Bankruptcy Court, when proofs of debt for £430 were tendered. The receiving order was made on January 12th upon a creditor's petition, and in the absence of any proposal the case was left in the hands of the Official Receiver to be wound up under an order for summary administration.

J. N. DAVENPORT and L. A. HACKETT (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens and Albert Mills, Albert Street, Manchester.—First dividend of 2s. 6d. in £ payable February 12th at 21, Spring Gardens, Manchester.

G. H. DIXON, electrical contractor, 46, Market Place, Dewsbury.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released January 18th.

C. PEACOCK, electrical engineer, 51, Gillygate, York.—Trustee, Mr. D. S. Mackay, Official Receiver, Duncombe Place, York, released January 14th.

Company Liquidations.—GAS & ELECTRICAL SECURITIES, LTD., 14 & 16, Cockspur Street, W.—The statutory first meetings were held on January 26th, at Carey Street, W.C. The winding-up order was made on the petition of the Northern Exploration Co., Ltd., London Wall, E.C., returned as creditors for £16,000 in respect of calls on shares. The company was formed in February, 1923, with a nominal capital of £1,000, to invest funds in the purchase of securities of any kind and description in any part of the world. The accounts filed under the liquidation show total liabilities of £19,512 (unsecured £18,293), assets of £2,471, and a deficiency of £15,824 as regards contributories, the issued capital consisting only of three ordinary shares of £1 each. The liquidation was left in the hands of the Official Receiver.

EAGLE ELECTRICAL MANUFACTURING CO., LTD., 32, Charlotte Street, W.1, electrical and wireless manufacturers.—A meeting of creditors was held on January 27th. The liquidator of the company, Mr. E. H. Henry, said that one of the creditors obtained judgment some time ago and had sold the place up. Continuing, he said that a lot of work had been done in putting in wireless sets for different hospitals, and there were a number of orders for further contracts which, if they had been able to carry them out, would have been very profitable. As soon as the sheriff sold, namely, on December 23rd, the necessary resolution was passed for voluntary liquidation. According to an approximate statement of affairs the liabilities amounted to £1,093. The only assets were certain book debts amounting to £313, but the liquidator said that he did not think that these would realise more than £75. From that amount had to be deducted preferential creditors amounting to £68, leaving net assets of £7. The company was incorporated in July, 1924, with a nominal capital of £1,500. A resolution was passed confirming the appointment of the present liquidator.

The following are creditors:—

	£		£
Chadwick Healey	279	Lighting, Heating & Glass Co.	58
E. H. Henry	23	Mullard Radio Valve Co., Ltd.	157
Brown, S. G., Ltd.	67	Siemens Bros. & Co., Ltd. ...	60

RE-ECHO RADIO CO., LTD.—Winding up voluntarily. Liquidator, Mr. C. H. Whatley, 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C. Meeting of creditors at the liquidator's offices on February 10th. Particulars of claims to the liquidator by February 27th.

Calendar and Diary. — We have received from the HART MANUFACTURING CO., 76 and 77, Rochester Row, S.W.1, a 1926 diary, comprising monthly date slips upon a wall card illustrating "Diamond H" switches.

THE EDISON SWAN ELECTRIC CO., LTD., have sent us a pocket diary neatly bound in dark red leather, with a week to each double page.

Private Arrangements.—I. M. B. OLIPHANT, E. R. WHITFORD, and C. C. JOHNSON, trading as the Campbell Radio Store, 2, St. Catharine's Road, Southbourne, Bournemouth.—A meeting of creditors was held on January 27th, at the offices of Mr. Parkin S. Booth, Holborn Viaduct, E.C. The statement of affairs of the joint estate showed liabilities of £1,389 and net assets of £1,185, leaving a deficiency of £204. The separate estate of E. R. Whitford showed liabilities of £9, with assets of £35. The separate estate of C. C. Johnson showed liabilities of £166 and no assets, and that of I. M. B. Oliphant disclosed liabilities of £312 against assets of £977, a surplus of £665. Mr. Booth reported that the business was commenced by C. C. Johnson in September, 1924, without capital. In November of the same year Whitford joined the business, bringing in £250. The third partner joined the business in May, 1925, and introduced £250 in cash. A deed of partnership was entered into, under which each of the partners was credited with a capital of £250, and it was arranged that they should each draw equal amounts. In July last Mr. Whitford, senior, advanced £300 to the partnership, for which he was still a creditor. In August Oliphant brought in an additional £222 as a loan. Approximate accounts to October 16th last showed a net loss of £400. Efforts had been made to obtain further capital, but without success. Whitford desired to leave the partnership, and a deed of dissolution was prepared, but had not been executed. The deficiency was accounted for by the writing down of the assets and the loss on trading. Creditors had been pressing, but no proceedings had been commenced. There was no offer, and a deed had been executed to protect the assets. A resolution was passed in favour of the matter being dealt with under a deed of assignment with Mr. Booth as trustee, whilst a committee was nominated, consisting of Messrs. C. Latham (Wireless and Radio Trades Guardian Association), W. A. J. Osborne (British Traders' Association), and E. H. Hawkins (Poppleton, Appleby & Hawkins).

The following are creditors:—

	£		£
British Thomson-Houston Co., Ltd.	23	Marshall & Co.	41
C. A. C. Radio, Ltd.	22	Motor Mags, Ltd.	45
Eyers, H. P., & Co.	44	Richards, G. T.	23
General Battery Co., Ltd. ...	75	Ward & Goldstone, Ltd.	45
Houghton Butcher (Gt. Britain)	372	Summit Manufacturing Co., Ltd.	146
Hewitt, H.	27	Sel-Ezi Wireless Supply Co., Ltd.	20

Dissolution of Partnership.—GLOVER BROS., electrical engineers and general machinists, Windsor Street, Coventry.—Mr. H. J. Glover and Mr. H. W. Glover have dissolved partnership. Mr. H. W. Glover will attend to debts and continue the business.

An Exhibition of Business Machines.—The International Business Machines Co., Ltd., and the International Time Recording Co., Ltd., have recently opened new showrooms and offices at 112, Strand, W.C.2. Here are displayed a number of aids to business efficiency. A large number of time-recorders for offices and factories are shown, as well as the Time Recording Co.'s system of synchronised electric clocks. One useful device of an electrical nature which is exhibited is a door recorder. This is attached to a door lock and at the same time is connected in an electric-clock circuit. A set of keys, each allotted to a particular individual, is provided, and when the door is locked or unlocked the time is recorded as well as an identification of the person concerned. It is especially applicable to strong rooms, but it has many other uses. Examples of "Dayton" food-preparing machines are on view. All of these are compactly built, having the driving motor incorporated in them. The range includes coffee grinders and sausage machines. A further useful device is the "Ticketograph" system, by means of which the costing of piece work is greatly simplified.

Book Notices.—"The Electrical Educator."—In the parts four to nine of this work, the prospectus which we referred to in our issue of October 16th last in connection with the first two parts has been continued and extended. Although the work in the main is a practical treatise on electrical engineering, it is so written as to make a pleasing departure from the usual text-book style, each part touching on several phases of the subject as part contributions or lessons, with the introduction of special articles by distinguished engineers on subjects of general electrical and industrial interest. Among the many eminent contributors are Messrs. A. P. M. Fleming, C.B.E., and John Bruce, A.M.I.E.E., Sir Charles Bright, F.R.S.E., Messrs. D. N. Dunlop, and H. Dickinson, M.Inst.C.E. The work is being published by Sir Isaac Pitman & Sons, Ltd., in 30 fortnightly parts (at 1s. 3d. each).

"Radio and High-Frequency Currents," by E. T. Larner. Second edition. Pp. vii+64; figs. 30. London: Crosby Lockwood & Son. Price 2s. 6d. net.

"Surface Water Supply of Canada: St. Lawrence and Southern Hudson Bay Drainage (Eastern Section), Quebec, Climatic Year 1922-23." Water Resources Paper No. 41. Ottawa: Director, Dominion Water Power and Reclamation Service. (London: High Commissioner for Canada.)

Technologic Papers of the U.S.A. Bureau of Standards. Vol. 19, Nos. 297 and 298, 1925.

Scientific Papers of the U.S.A. Bureau of Standards. Vol. 20, No. 515, 1925.—"Thermal Expansion of Tungsten."

Miscellaneous Publications of the U.S.A. Bureau of Standards. No. 66, 1925. Second Technical Conference of State Utility Commission Engineers.

"The Enlarged Heat Drop Tables," h.p. gauge pressures, l.p. absolute pressures, calculated by Dr. H. Moss from the formulæ and enlarged steam tables of Prof. H. L. Callender. Pp. 88. London: Edwin Arnold & Co. Price 10s. 6d. net.

"Atomicity and Quanta," by J. H. Jeans. Pp. 64. London: Cambridge University Press. Price 2s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLV, No. 1. January, 1926. New York: The Institute. Price $1.

Revised Indian Import Duties.—The *Board of Trade Journal*, dated January 28th, contains schedules of the revised import and export duties instituted by the Government of India as from January 1st. Among the articles affected by the revision are electrical control gear and transmission gear (15 per cent. *ad valorem*); telegraphic instruments, apparatus and parts imported for or by a railway company (10 per cent. *ad valorem*); tramcars (15 per cent.); tramway track material (10 per cent.); certain prime movers and other machinery (2½ per cent.); and electrical wires and cables and transmission system fittings and parts (2½ per cent.).

Guarding Against Fraud.—Although but recently instituted, the scheme of the Federation of British Industries for the exchange of credit information has already achieved a large measure of success. Over 1,500 firms are participating, and the service covers every important trade in the country. The number of names of undesirable traders which have been notified to participants has reached over 800, and the total is increasing at the rate of 80 per week; 40 per cent. of the defaulters are of foreign origin. The working of the scheme has disclosed a number of methods adopted by these fraudulent traders. The commonest type of fraud is a declaration of inability to pay, all assets having previously been made over to the defaulter's wife or other near relative. The next most prevalent type is the long firm fraud, in which goods are sold to untraceable persons, and a number of aliases are employed. Another common method of fraud is a refusal to accept delivery after goods have been sent to a foreign market; they are afterwards bought at "knock-down" prices at public auction. Sometimes expensive samples are obtained from firms and sold. A common trick is to give two or three small orders, which are paid for promptly, followed by a large order for which the money cannot be obtained; and sometimes the disappearance of the defaulter is involved. A method of fraud commonly met with among foreign firms is the obtaining of a large order for goods by a trick; there are a number of ways in which this can be done. Some purchasers will, months, or years, after payment is due, question the quality of goods sent to them. Finally, it sometimes happens that an agent will double an order for a client, and when he finds that he is unable to dispose of the extra goods, he will repudiate the transaction and default.

E.D.A. Activities.—The British Electrical Development Association has sent us a copy of its sixth instalment of publicity matter which is appearing in the national Press. These advertisements are specially designed for the class of paper in which they are to appear; they are excellent examples of their kind, and should be productive of good results.

Siamese Electrical Imports.—A report upon the commercial situation in Siam during the year ended March 31st, 1925, by Mr. E. G. Sebastian, lately Acting Consul-General at Bangkok, states that the value of imported electrical goods and apparatus declined from 1,150,507 ticals to 796,294 ticals (£1=10.89 ticals). The value of the United Kingdom's share, however, rose to 350,000 ticals, and this country thus recovered the first place from Germany, whose contribution was 130,000 ticals, as compared with 328,343 ticals in 1923-24. It is stated that Denmark has almost dropped out of the market.

The Position of the Wireless Trade.—In the course of an article appearing in the *Wireless Trader* under the title, "The Year—What Will it Become?" the writer says:—"Then, again, we have a complete unheaval of the leading manufacturers and trade association. The trader does not know exactly what this is going to mean to him, but in a half-hope that it will mean better discounts, he holds off buying at a time of the year when he should put forth all his energies.

"Surely, Mr. Trader, the veriest novice in economics can work out the problem for himself? The manufacturer is not so foolish as to increase the price of his goods to the public, and, with a few exceptions, his profit is already so small that to give away any more of it would be running a serious risk of disaster; while, with the increases in the prices of various raw materials, such as ebonite, he is not likely to be saving much in production costs.

"How, then, is he going to find you that extra large lump of discount which you hope is going to appear as a result of a temporary break in his ranks? Obviously, the only way in which you can possibly hope to increase your discount is to send the manufacturer more orders, and thus lower his overhead charges through increased production. Therefore, if you are looking for an increase in discounts, you should be pushing sales for all you are worth, so that you may increase your orders."

Russian Orders for Germany.—It is reported from Dusseldorf that a further contract has been entered into between the Donugol (South Russian Coal Trust) and various German firms for the establishment of power stations at an expenditure of £750,000. The participating firms are the A.E.G., Siemens & Halske, Felten & Guilleaume, and two mechanical engineering works. Further negotiations with the same group are said to be still pending for other works of a similar kind.

Coal, not Electricity, the Panacea.—Addressing the Glasgow Chamber of Commerce on January 26th, Sir Adam Nimmo said that the only sound and stable policy for the industries of this country was the production of increasing quantities of coal. Unification, electrification, carbonisation, and nationalisation of royalties were no remedies for our troubles.

Australian Companies.—Installation and Equipment, Ltd., is the name of a company recently formed in Sydney, with a capital of £10,000, to carry on business as electrical engineers and contractors, &c.

The name of the Western Electric Co. (Australia), Ltd., has been changed to Standard Telephones and Cables (Australia), Ltd.

The British Electric Transformer Co. (Australia) Pty., Ltd., has been formed in Melbourne with a capital of £10,000 to carry on business as electrical engineers, ironfounders, &c.

The P. & B. Battery Co., Ltd. (capital £5,000), has been formed in Melbourne for dealing in and manufacturing electrical machinery, &c.

South African Electrical Imports.—According to the *Board of Trade Journal*, the imports of electric cable and wire into South Africa during the first seven months of 1925 were valued at £368,119.

New All-Electric House and Showroom.—The Rotherham Corporation has approved a proposal by the electrical engineer (Mr. E. Cross) to convert premises in Rawmarsh Road, now utilised by the department as a stores, into an all-electric home for demonstration purposes. Mr. Cross states that the cost of the conversion will be inconsiderable, and that the work can be carried out by his staff. He proposes to furnish the premises for demonstration purposes as a living room, sitting room, scullery, bedroom, and bathroom, and to utilise a large room adjoining as a showroom for domestic electrical appliances.

The Building Trades Exhibition.—It is announced that the Lord Mayor of London will open the Building Trades Exhibition at Olympia on April 14th.

United States Radio Exports.—Department of Commerce statistics show that radio goods valued at $8,936,565 were exported during the first 11 months of 1925, as compared with $4,950,746 during the same period of 1924. Radio exports now constitute 12 per cent. of the total foreign electrical trade of the United States.—*Reuter's Trade Service* (Washington).

Unemployment.—There was a fall of 5,503 in the number of registered unemployed persons during the week ended January 18th, the total at that date being 1,215,900. The number at the equivalent date last year was 1,269,733.

Engineering Employés' Wages.—A joint conference of representatives of employers and trade unions connected with the engineering industry, held on January 28th, broke up without reaching any agreement. The negotiations were commenced in June, 1924, upon an application from the men for a general increase in wages of 20s. per week. The employers offered an increase of 2s. per week in the bonus if the men would agree to an extension of the working week from 47 to 50 hours and other modifications, but this was not accepted. At the conclusion of the conference Mr. J. T. Brownlie, of the Amalgamated Engineering Union, said that the unions considered themselves free to take what action they thought fit. The employers replied, through Sir Allan Smith, that they thought insufficient consideration had been given to the condition of the industry as outlined in their statement. It is thought that the unions may now resort to negotiation by districts having failed to secure a national increase. Part of the proceedings of the conference consisted of the presentation of a report relating to the possibility of bringing conditions in the Continental engineering industries to the same level as our own. Italy, Germany and Belgium, in response to letters from the Minister of Labour, have signified their willingness to confer on the matter, but no reply has yet been received from France.

According to the *Financial Times*, trade union leaders in the Newcastle engineering industry state that the deadlock was due to the interpretation of the position by the employers—namely, that so long as the national negotiations were pending, no other question affecting wages could be considered by them. It is claimed on the men's side that the engineering trade is in a moderately good condition and that the state of it in certain branches is such as to warrant an immediate advance in wages. The executive representatives therefore decided in the interests of their members that where an advance in wages was warranted it was necessary to terminate the negotiations in order to allow claims from members in their respective districts to be considered without reference to the national procedure as interpreted by the employers.

New Italian Companies.—Among the electricity supply undertakings recently formed in Italy are La Società Cadorina di Elettricita, organised in Genoa with a capital of one million lire; La Società "La Luce," of Trebisacce (Castrovillari), 80,000 lire; La Società Imprese di Elettricità U. Sampietro, Trento, 1,500,000 lire; and La Società Elettrica Carnica, Udine, 1,600,000 lire.

Electrical Trades Commercial Travellers' Association.—A well-attended social evening was held on January 22nd, at the E.L.M.A. Rooms, by the Association, when a lecture was given by Mr. W. E. Bush. Refreshments were provided during the evening, and these were followed by a demonstration of "Lighting in the Home" by Miss Florence Hodge. By means of a revolving stage, the different lighting which should be used for each room throughout the house was shown in its natural surroundings, and was, in each case, contrasted with the unsuitable types of lighting which are so often seen. Mr. E. A. Joyce proposed a vote of thanks to Mr. W. E. Bush and Miss Florence Hodge, and Mr. Bush replied.

Building Exhibition at Edinburgh.—A Housing and Building Exhibition is to be held in Edinburgh from February 10th to 20th. Among the exhibitors is the Yorkshire Copper Works, Ltd., which is displaying examples of its light-gauge copper tubes.

A Scottish Protection Association.—The annual meeting of the Scottish Electrical Manufacturers' and Factors' Association was held in Glasgow last month. The secretary reported an increase in the membership. A resolution was passed permitting the admission of all manufacturers, factors, and wholesalers, trading in or with Scotland, to an extent deemed sufficient by the Association. Mr. A. B. Ames (British Electrical & Manufacturing Co., Ltd.), was elected chairman, and Mr. J. F. Stevenson (Macintosh Cable Co., Ltd.), vice-chairman. The secretary is Mr. H. C. McMillan, 13, Dundas Street, Glasgow.

German Electrical Supplies for Uruguay.—The firm of Siemens-Schuckert has received permission to erect a large branch house and works at Montevideo under the name of Compañia Platense de Electricidad Siemens-Schückert. There is a scarcity of certain electrical supplies, the requirements of the State being unsatisfied. All purchases of electrical apparatus for the Government and private stations will continue to be effected by means of public tenders.—*Reuter's Trade Service* (Montevideo).

For Sale.—Mr. H. J. Shaw will sell by auction on February 18th, at 13, High Holborn, the stock of a wireless goods factor; Messrs. Fuller, Horsey, Sons & Cassell will offer by auction on March 2nd and following days, at the Cubitt Engineering Works, Aylesbury, Bucks., the entire contents of the works, comprising engineers' machine tools, motor-body building plant, electric power plant, stores, and material, &c.; the Secretary of the North of Scotland College of Agriculture, Aberdeen, invites offers for one 20-b.h.p. and one 15-b.h.p. electric motors. (See our advertisement pages to-day.)

Lighting and Power Notes.

Australia.—TASMANIA.—According to *Tenders*, a sum of £81,000 has been appropriated by the Tasmanian Parliament for extensions to the State hydro-electric system. Of this amount £50,000 will be expended on extending the supply to north and north-west coast towns, the completion of the purchase of the Davenport power station, £1,500; mains extensions, transformers, house service meters, &c., in connection with country retail services, £4,500; mains, transformers, house services, meters, and general extensions retail services, Hobart district, £25,000.

Barnstaple.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £1,920 for mains and services, and £600 for meters.

Barry (Glam.).—ELECTRICITY SCHEME.—Specifications have been prepared for the cables and sub-station in connection with the Urban District Council's electricity scheme. A contract has been entered into between the Council and the South Wales Electrical Power Distribution Co., for a supply in bulk.

Bristol.—INQUIRY.—An inquiry was held at the Council House on January 26th by Col. T. C. Ekin, of the Electricity Commission, into the proposal of the Corporation to erect a new power station at Portishead. The Town Clerk, for the Corporation, stated that the plant at the Feeder Road works would shortly become insufficient, and it was necessary that additional plant should be available before the winter of 1927. Extension at Feeder Road was impracticable owing to water shortage, and in any case the extension would only postpone, at serious expense, the ultimate construction of a new station within a very short time. The scheme provided, as a first instalment, for plant with a capacity of 40,000 kW, and the estimated cost was £980,704, which included £246,204 for underground cables. Mr. Faraday Proctor, chief electrical engineer to the Corporation, stated that, except near Gloucester, there was no site other than that at Portishead. It was mentioned that the full scheme, if developed to 240,000 kW, would cost three millions. Mr. J. C. Peck (representative of the provisional contractors) said that there would be no question of nuisance from noise or vibration, and Mr. J. W. Gibson stated that the mechanical draught plant would obviate any risk of nuisance from dust or smoke. Mr. J. C. Glyde, clerk to the Portishead Council, said that every precaution should be taken with regard to noise, smoke, and dust, and that there should be as little depreciation of property as possible. The principal objection of Portishead with regard to boundaries was being negotiated. Objections were also raised by the National Citizens' Union and the Bristol Ratepayers' Association. The Commissioners will give their decision in due course.

China.—ELECTRICAL DEVELOPMENT.—In a recent issue of the Siemens *Zeitschrift*, Herr K. Mosig gives some particulars of the first high-pressure transmission installation in China. The power station is located on the Suchan River and near the Shanghai-Nanking railway. The initial plant comprises two 3,200-kW Zoelly-type turbo-generators running at 3,000 r.p.m., but it is intended later to install two 10,000-kW sets. The current is stepped up from 6,600 V to 33,000 V for transmission purposes to the towns of Shangschau and Wusie, a distance of 6¼ and 20 miles respectively, and is reduced at sub-stations first to 2,300 V and then to 380/220 V.

Chester.—LOANS.—The Town Council has approved of application being made for sanction to borrow £3,000 for the purpose of wiring small houses on the hire-purchase system, £3,970 for the purchase of transformers, £17,870 for the purpose of carrying out various works, and £12,000 for the purpose of replating the storage battery at New Crane Street.

Chesterfield.—NEW CONVERTER.—The Council proposes to borrow £5,500 for the erection of a 1,000-kW rotary converter at the electricity works in order to meet the estimated additional demand for electricity in the next three years.

Continental.—POLAND.—On the initiative of the Minister of Public Works, the National Economic Bank is discussing with the American and European Utilities Corporation the partial realisation of the electrification programme drawn up by the Minister of Public Works. A committee is at present studying the economic condition of the country to be electrified.—*Reuter* (Warsaw).

FRANCE.—The Compagnie d'Energie Electrique du Littoral Mediterranean has drawn up a scheme for the electrification of the villages and agricultural districts in the Vesubie valley of the Alpes Maritimes Department. The scheme includes the establishment of a 20,000-V transmission line between Saint Martin and Vesubie.

The Compagnie Electrique de la Loire et du Centre is replacing a 1,500-h.p. steam turbine which has been in use at its power station at Monthucon since 1907, with a modern one of 4,400 h.p. A new hydro-electric station of 14,000 h.p. capacity is also in course of construction at Monistrol d'Allier, and is expected to be completed by the end of the current year.

SPAIN.—The Sociedad Productores de Fuerzas Motrices, which is erecting a large hydro-electric station to utilise the Clede Falls at Pobla de Segur in the Pyrenees, is preparing plans for the transmission of the electricity generated to Barcelona. In order to ensure an uninterrupted supply, arrangements have been concluded with the Sociedad de Carbones de Berga which operates certain lignite mines near Barcelona, to establish a reserve steam-operated power plant in connection with its mines.

GERMANY.—A Berlin message states that the Swiss Government has approved the contract of the Swiss Power Transmission Co. and the Baden electrical undertakings for the mutual exchange of electrical energy.

Crowborough. — ELECTRICITY EXTENSIONS. — The Crowborough District Gas and Electricity Co. recently instructed its engineers, Messrs. A. Hugh Seabrook & Partners, to extend the plant at the generating station, and orders have been placed for a four-cycle oil engine and alternator, which it is expected will be available for service this month.

Croydon.—ELECTRICITY EXTENSIONS.—The electrical engineer has prepared a scheme for the development of the electricity undertaking at a total cost of £59,000.

LOANS SANCTIONED.—The Electricity Committee has received sanction to loans of £1,300 for buildings, £13,000 for mains, and £4,600 for plant and alterations to buildings.

MAINS EXTENSIONS.—The Committee has decided to extend mains at a cost of £3,350.

Darwen. — ELECTRICITY SUPPLY. — The Corporation has applied for sanction to extend its generating plant, but at the request of the Mid-Lancashire Electricity Advisory Board, has agreed to an interview with the Blackburn Corporation to ascertain whether an arrangement can be arrived at. The Electricity Commissioners have authorised the Council to borrow £40,000 for extensions to mains, services, &c.

Edinburgh.—DEPUTATION TO VISIT PARIS.—In connection with the extension of Portobello power station the Corporation Electricity Committee has recommended that a deputation of five members should be appointed to visit the Gennevilliers power station in Paris.

Gainsborough.—ELECTRICITY SCHEME.—Tenders for an electricity scheme are now before the Urban District Council, and it is hoped that a supply will be available by the winter of 1926.

Irish Free State.—WATERFORD SCHEME.—Opposition was made by the Chamber of Commerce and certain ratepayers at an inquiry held in the town, before an inspector of the Irish Free State Local Government Board, into the Corporation's application for a loan of £30,000 for an electricity scheme. The inspector declined to take evidence as to whether the scheme should or should not be adopted, holding that that had been decided by the granting of a Provisional Order. It appeared that a referendum of city householders gave a majority against the scheme, only four voting in favour. Alderman Keane, mayor, gave evidence in support of the scheme, pointing out that a considerable area of the city was not at present lighted. Testimony on behalf of the opposition was to the effect that the Corporation's proposals were uncommercial, and that the scheme would cost up to £50,000 to complete. The inspector's report will be presented to the Government in due course.

Japan.—ELECTRICAL DEVELOPMENT.—The Toho Denryoku's Nagoya steam power station of 25,000 kW has recently been completed, and good progress is being made with the construction of the Tsurumi station of 70,000 kW. The Tokyo Dento K.K. is to erect a power station of 150,000 kW imme-

diately on completion of one of 50,000 kW at Lenju. Concessions have now been issued for nearly all the important sites for hydro-electric development in the neighbourhood of the large cities, and future development may only be expected on the Shinano River, the Oi River, and Fuji River. On these rivers the power stations projected are all on a large scale, varying from 150,000 to 100,000 kW.

Lancaster.—EXTENSION OF SUPPLY.—The Corporation has decided to spend an additional £6,000 on a cable to supply the new garden city of Bowerham where over 100 houses are in course of erection.

Leeds.—EQUIPMENT OF SMALL HOUSES.—At a recent joint meeting of representatives of the Electricity, Gas and Improvements Committees of the City Council, authority was given for 34 houses on certain new Corporation estates to be equipped as all-electric and 34 to be equipped as all-gas.

Long Sutton.—ELECTRICITY SUPPLY.—The Urban District Council is to ask the Boston and District Electricity Supply Co., Ltd., whether it would be prepared to provide a supply of electricity for the town, and as an alternative endeavours are to be made to obtain a supply from King's Lynn and Wisbech.

Ludlow.—TRANSFER OF UNDERTAKING.—The Town Council has completed an agreement with the Ludlow Electric Light Co., under which the electricity undertaking is to be transferred to the Corporation on June 30th.

Luton.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £25,000 for mains and services, and £7,500 for sub-station equipment.

Maghull.—ELECTRICITY SCHEME.—At a recent meeting of the local Council it was decided to adopt a scheme of electric lighting. Mr. James Scott, of Bootle, electrical engineer to the West Lancashire Rural District Council, estimated the total expenditure at £12,000, and that electricity could be supplied for lighting at 9d. per kWh.

Marlborough.—STREET LIGHTING.—The Town Council has instructed Mr. G. W. Molle, of Messrs. A. Hugh Seabrook and Partners, to arrange for the changing over of the street lighting from gas to electricity.

Morecambe.—ELECTRICITY SUPPLY.—The borough electrical engineer, reporting to the Town Council on the progress of the scheme for a second cable from the source of supply at Lancaster, said that the situation was altered by the L.M. & S. Railway Co.'s negotiations with the Lancaster Corporation for a supply to its railway, Heysham Harbour and other works. He therefore submitted an amended scheme and estimate of £17,000, in which the Lancaster and Morecambe Corporations and the railway company are jointly interested. The scheme has been approved by the Electricity Committee, and the Corporation has been requested to give its sanction.

Price Reductions.—Reduction in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*Westminster Electric Supply Corporation, Ltd.*—Lighting: For the first 4,000 kWh per annum, 5d. per kWh; all consumption in excess of this amount, 4d. per kWh. Heating, cooking, and motors: If taken through a separate meter, 1d. per kWh.

COVENTRY.—H.p. or bulk supply: The increase in the basic rate from 15 to 10 per cent. Power (l.p. supply) and heating: Flat rate from 1¼d. to 1½d. per kWh. Lighting: Maximum demand rate from 8d. to 7d. per kWh for the first hour per day, the second hour remaining at 3½d. per kWh, and thereafter from 1¼d. to 1½d. per kWh; flat rate from 4d. to 3½d. per kWh.

CHISLEHURST.—*The Chislehurst Electric Supply Co., Ltd.*—The charge for electricity reduced by 1d. per kWh.

RUGBY.—Power: 1½d. per kWh, with a minimum charge of 10s. per h.p. installed. The charge for h.p. supply has also been reduced.

New Zealand.—ELECTRICITY SCHEME.—The New Zealand Sounds Nitrates Syndicate has been granted a 60 years' licence by the Government to generate at Smith's Sound a force of 300,000 continuous h.p., 50,000 h.p. of which is to be developed within seven years, while the construction of works to generate the balance must be begun within 10 years. The Government retains the right to resume possession with compensation at the end of 30 years. The power produced is to be used for electrochemical, metallurgical, and other purposes. The rental payable to the Government is 1s. per annum per kW.—*Reuter's Trade Service* (Wellington).

Peak District.—ELECTRICITY SCHEME.—Although the matter of providing an electricity supply to a number of districts in the Peak District has been considered by various local authorities at the request of the South-East Lancashire Electricity Advisory Board, no definite steps have been taken by those bodies, and intimation has now been made by a private company that it intends to prepare a scheme for a supply which will link up Chapel-en-le-Frith, Whaley Bridge, Hayfield, and Chinley.

Peterborough.—LOAN.—The Town Council is applying for sanction to a loan of £10,420 for the following purposes:—H.p. and l.p. switchgear, £8,666; and a fifty-ton crane, £1,754.

Plymouth.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £12,017 in connection with electricity supply in the Lipson Vale and Laira districts.

MAINS EXTENSIONS.—The Electricity Committee has approved mains extensions involving an expenditure of £1,643.

Preston.—STREET LIGHTING.—The Corporation Electricity Committee has had under consideration alternative side-pole and central-suspension schemes of lighting for certain thoroughfares, and has recommended the Corporation to approve of the side-pole scheme at a cost of £1,080, with an annual running cost of £360 for 36 lamps.

NEW PLANT.—The Committee has received sanction to extend the power station by the installation of a third 12,500-kW turbo-generator and auxiliary plant.

LOAN.—Sanction has also been received to the borrowing of £20,000 for changing over in the Avenham and Deepdale districts, and for laying new feeder mains in other districts.

Rawtenstall.—CORRECTION.—In our last issue (p. 179) we stated that the Corporation had received permission to increase the plant at its electricity works to reach 6,000 kW. The plant capacity is already nearly 15,000 kW (which is the largest capacity per inhabitant of any town in the United Kingdom); the proposal is to increase the capacity *by* a 6,000/7,500-kW set.

Shoeburyness.—ELECTRICITY SUPPLY.—The Urban District Council has instructed its Parliamentary agents and engineers to prepare an electricity scheme and draft Order for submission to the Electricity Commissioners. Negotiations are in progress with the War Department for a supply in bulk to the Council.

Special Orders.—Application has been made to the Electricity Commissioners for Special Orders by the following authorities:—The Urban District Council of Seaham Harbour for the supply of electricity in the urban district and in the parish of Seaham; the Borden and District Gas Co., to supply in certain parishes in the rural districts of Alton, Petersfield, and Midhurst; and the Llandilofawr Rural District Council in the parish of Llandybie.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising Messrs. Crompton & Co., Ltd., to supply electricity in the urban district of Wellington.

Stoke.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £5,500 for mains in connection with the supply of electricity in the Hanley area.

The Fylde.—ELECTRICITY SUPPLY.—A meeting of local authorities, on January 21st, considered a proposed electricity scheme for the Fylde district. The meeting decided to obtain the advice of an electrical engineer as to whether a scheme could be formulated for the joint townships to supply electricity directly without vesting the Preston Corporation with full control.

Tynemouth.—LOAN.—The Electricity Committee is applying for sanction to a loan of £16,000 for the electricity undertaking.

Walton-on-Thames.—PURCHASE OF UNDERTAKING.—The Urban District Council, on January 18th, decided to give notice of its intention to purchase the local electricity undertaking of the Urban Electric Supply Co., Ltd., at a cost estimated at £90,000.

Wrexham.—ELECTRICITY SUPPLY.—The Town Council has adopted a scheme for laying new a.c. underground distributors at an estimated cost of £12,000.

Tramway and Railway Notes.

Bradford.—TRAMWAY IMPROVEMENTS.—The Estimates Sub-Committee has approved the Tramways Committee's scheme for the reconstruction of tramway track as follows:—Manningham Lane, North Parade to Oak Lane, £27,715; Barkerend Road, Otley Road to Byron Street, £14,740; Rushton Road to Leeds Road, £8,262; and also for the purchase of ten motor 'buses (£11,834) and six railless cars (£8,925).

Continental.—POLAND.—The tramway workers in Warsaw struck work on January 28th. According to *The Times*, the dispute was the result of the men's demand for increased wages.

East Ham.—RAILLESS-CAR SCHEME REJECTED.—In connection with the Borough Council's proposal to promote a Parliamentary Bill for the substitution of railless cars on one of the routes of its present tramway system, and to extend the railless-car service in other directions, a poll of ratepayers taken on January 26th resulted in a large majority against the proposal. The cost of the scheme was estimated at more than £150,000.

Huddersfield.—TRACK RENEWALS.—The Tramways Committee has considered a report from the borough engineer on the condition of the tramway track, and has decided to reconstruct the following sections in the order named:—Apsley section, from Shore Head to Somerset Road; Newsome section, from Chapel Hill to Bridge Street (with an additional loop); Northumberland Street, Northgate to John William Street, outward track; Birkby section, from John William Street to Wheathouse Road; Manchester Road, from Longroyd Bridge (River Bridge) to Griffin Inn.

(*Continued on page 223*)

An Electrical-Instrument Works.

A Visit to the Works of Messrs. Nalder Bros. & Thompson, Ltd.

THE firm of Nalder Bros. & Thompson, Ltd., whose works are now established at Dalston, was commenced in 1884 by Messrs. F. H. Nalder and H. Nalder,

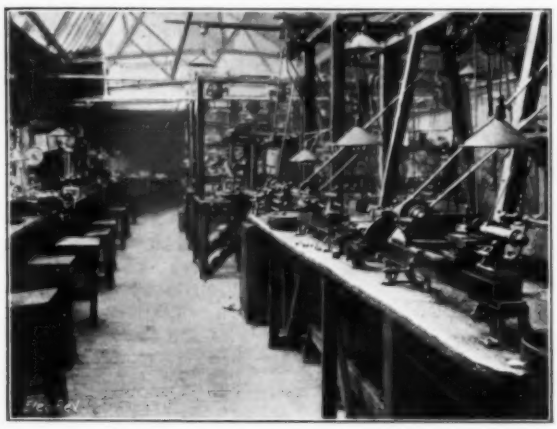


Fig. 1.—Major-Assembly Shop

under the style of Nalder Bros., with its headquarters at Westminster and a small works at Brentford. It soon became necessary to seek larger works, and in early 1887 the factory was moved from Brentford to Westminster, about which time a partnership was taken in the concern by Mr. C. W. S. Crawley, and business was carried on under the name of Nalder Bros. & Co. Soon afterwards the firm was joined by Mr. Alfred Soames, and in 1890 its continued progress necessitated another move, new works being established at Clerkenwell. In 1896 it was decided to split the business, due primarily to the ammeter and voltmeter business having increased to such an extent that it had become advisable to departmentalise the production. Mr. F. H. Nalder purchased the goodwill and plant of the ammeter, voltmeter, and switchboard department, remaining a partner in the parent firm until 1897, and was joined in the fresh enterprise by Mr. E. Thompson. The new firm was established under the name of Nalder Bros. and Thompson, with its works at Queen Street. The undertaking was converted into a private limited company in 1899 with Mr. F. H. Nalder as chairman and managing director, which position he has continued to hold to the present day. Additional works were taken over at Kingsland Green, Dalston, and in 1914 the concern moved entirely to Dalston, other premises at the present headquarters, Dalston Lane, being equipped as a modern factory. The two last-mentioned premises in which, by the courtesy of the management and staff of the firm, we recently spent a particularly interesting day, accommodate the undertaking entirely. The products of the firm now include practically every kind of instrument and apparatus required for use in connection with the modern operating switchboard.

Fig. 2.—New Assembling Wing.

The Dalston-Lane works is devoted to the winding of the instrument coils, the assembling of all instruments and the smaller relays, the manufacture of small instrument parts, such as pivots, pointers, &c., and the testing and general finishing processes such as enamelling. The top or third floor is where practically all the instrument assembling is carried out by mechanics specialised in particular operations. A new wing to this floor, fig. 2, serves as a well-lit modernly-constructed instrument shop. It is of long and narrow construction, with the benches arranged so as to receive a maximum of natural light. The various movements, coils, coil supports, magnets, and the many other delicate parts are built up in this portion of the works. Some of the most interesting operations are the assembling of pivots, pointers, and control springs. Of outstanding interest in the work here is the assembly of the dynamometer instruments, in which a special construction of movement support is used, affording, it is claimed, a high resistance against eddy currents, &c. The work is arranged sectionally, so that each type of instrument receives entirely separate and individual attention. In the large adjoining room, fig. 1, the major parts are assembled in the cases before the movements are fitted. It is interesting to note that all sizes of instruments, varying from those with 22-in. scales down to small pocket instruments, are dealt with in the same shop. One of the most interesting

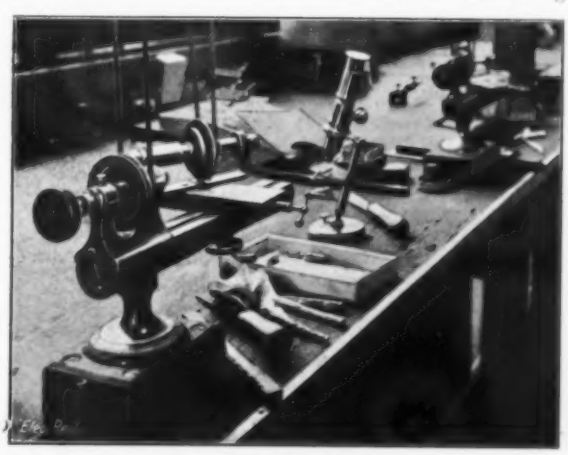


Fig 3.—Special Pivot Grinders.

operations here is the grinding of the very small hardened-steel pivots required for many of the movements. This is done on special grinding machines,

fig. 3, designed by Messrs. Nalder Bros. & Thompson. Both the grinding wheel and the spindle are revolved in separate containers at a convenient angle of relation, the necessary observation of the point of operation being made under a microscope. These machines are

Fig. 4.—Coil-Winding Machines.

belt driven from overhead shafting. A stamped flange, which is screwed on a special lathe and receives the pivot, is clamped to the movement.

The central floor of these premises accommodates the winding, enamelling, and junior assembling de-

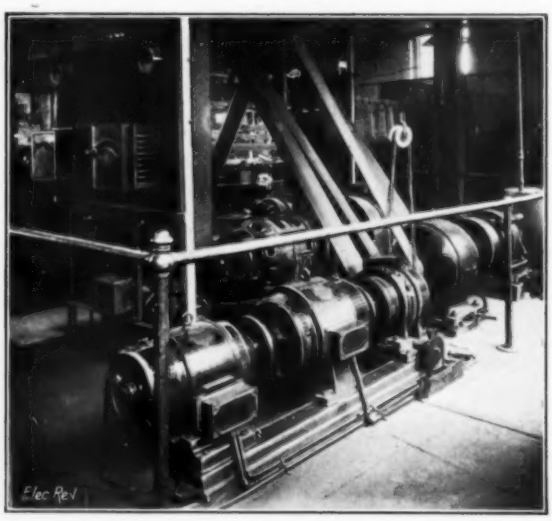


Fig. 5.—Testing Machines.

partments. Small coil-winding machines, fig. 4, driven by fractional-h.p. motors, deal with the fine-wire coils; counting gears are coupled to the spindles on which the coils are revolved. A machine for winding precision transformers with jointless-iron ring cores is a somewhat novel installation in this section. The transformer core and the "winding-off" bobbin are so revolved that one side of the continuous frame core only is wound. A compound-forcing plant is another feature: This treats coils intended for tropical countries, forcing compound between the layers and individual coils to increase the insulation and give protection against the entrance of ants. Two tanks, one vacuum and one compound, are provided; the coil, after being dried, is subjected to the hot compound under a pressure of 80 lb. per sq. in. A small winding room in which formerless coils are wound on special winding tools forms an additional portion of this department.

In any electrical instrument works the outstanding feature is undoubtedly the testing department, at any rate from the point of view of outside interest. The ground floor at the Dalton-Lane works accommodates the plant and apparatus required in this direction. It is here that the shaped tungsten-steel pieces from Kingsland Green are magnetised in coils carrying up to 1,000 A, according to the size and intensity of the magnet required. The magnets are aged by a similar method employing a.c. Sample magnets are periodically selected and kept for years under observation and test. The testing racks, which are arranged down each side of the test house, are equipped with standard cells and instruments, potentiometers and the usual testing apparatus for the calibration and standardisation of electrical instruments. A number of Kelvin balances, Siemens dynamometers, and Nalder potentiometers are used as standards, while a Crompton potentiometer provided with varying shunts of capacities up to 600 A is employed as a master standard. Tudor batteries are installed under the testing benches to provide the necessary supply for the d.c. work. The largest of these consists of six cells, each of 1,000-Ah capacity at 2 V. For the a.c. work a number of machines convert a 3-wire d.c. supply from the Hackney Electricity Department. A single-phase, 13-kW alternator supplies any frequency from 25 to 100 cycles per second to each rack by means of a series-parallel control of its field. Two small generator sets, 300 A, 15 V, are used for charging the batteries, and a 150-V generator is used for charging the special batteries for the voltmeter testing racks. A most interesting feature of the testing plant is a tandem combination, fig. 5, used to supply 3-phase energy for the calibration, &c., of power factor meters. It consists of a d.c. motor direct coupled to two alternators, one supplying current and the other creating

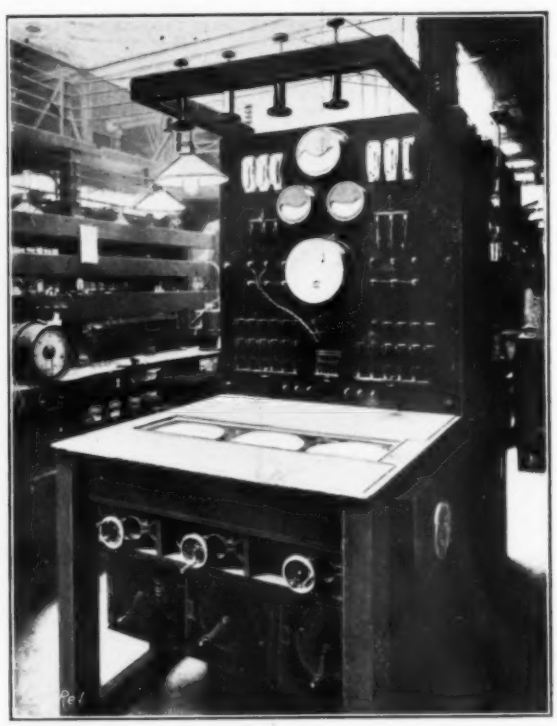


Fig. 6.—Three-Phase Testing Board.

the necessary potential difference. Both the rotors are fed from the same d.c. supply. The pressure machine has a movable stator, by means of which any phase relationship up to a total displacement of 360 deg. can be obtained. By regulating the speed of the

d.c. machine any frequency from 18 to 60 cycles per second can be obtained on the a.c. units. Each phase on the current alternator is wound with two coils, the ends of which are brought out separately to a special switchboard, fig. 6, equipped with 6-pole, 2-way switches arranged so as to give either series or parallel connections between the coils for either a star- or delta-connected 3-phase supply. The load on the machine is adjusted by means of a water resistance, which may be connected in star if desired. The stator of the pressure machine is revolved by a chain gear operated from the control board. Another machine used for the same purpose consists of a similar combination arranged vertically. A particularly interesting operation is the calibration of frequency meters. The supply frequency is calculated from the speed and design data of the machine supplying the apparatus under test; the machine speed is ascertained to a fine degree of accuracy by means of a stroboscope, the revolving disk being attached to the shaft of the supply machine. Rotary synchroscopes of the "Nalder-Lipman" pattern are tested under working conditions in conjunction with two alternators.

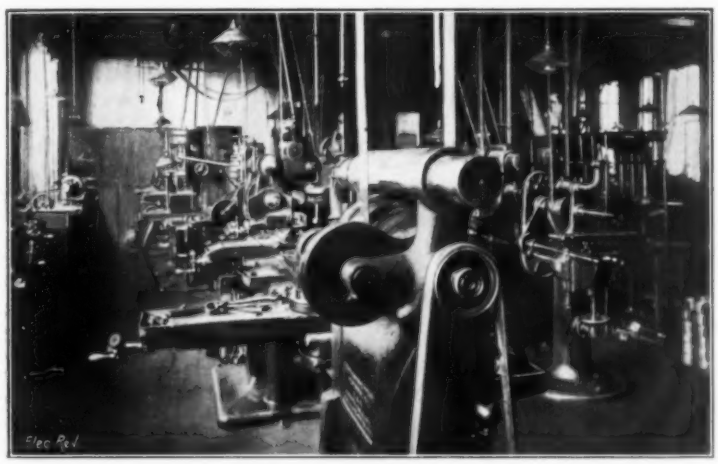


Fig. 7.—General Machine Shop.

An important and interesting section of the test room is the high-pressure section, where there is a number of "step-up" transformers of various ratings. The largest of these is a single-phase transformer of Messrs. Nalder Bros. and Thompson's own design and construction, having a maximum ratio of 110/160,000 volts, and its l.p. and h.p. windings arranged in sections, which may be readily connected in series or parallel according to the range desired, the pressure being adjusted by means of a choking coil in the l.p. circuit.

The Kingsland Green factory deals with the heavier operations necessary in the manufacture of electrical instruments and the complete manufacture of circuit breakers and heavy-current relays. On the ground floor are received the rough castings for the instrument cases and covers, which are dealt with on grinding and polishing machines. An interesting feature of this section is the shaping and hardening of the permanent magnets required for the various instruments, prior to their magnetisation in the other works. The first floor at Kingsland Green accommodates the machine shop. Here are capstan and automatic lathes, and turning, boring and milling machines of varying descriptions. Some of the automatic machines are engaged in making the very small screws, bolts, and nuts required for the instrument connections. Electric furnaces are installed for the softening of small cast-steel bars. Of particular interest in this department is the preparation of small aluminium formers required for some of the fine-wire coils for instruments and relays, &c. From stamped disks are punched cylindrical cups, reducing them to the required size in a series of operations. On a small hand-driven roller machine of the firm's own design is cut a collar of given width, and the edges of this are turned out to form small containing lips. The product is then mounted on a small expanding-core machine to receive its final shape. Shaping machines on which the metal chambers and plungers for instrument-damping apparatus are prepared, constitute another feature.

A part of the second floor is devoted to tool making; a large number of special shaping, cutting and stamping tools, used in making the ever-varying designs of instrument parts, are continually being manufactured. Some special automatic gear-cutting machines are engaged in cutting the teeth for the clock wheels required for recording instruments and time relays, &c., and also for clutches used in the generator-turning gears of testing apparatus, &c.

Fig. 7 shows a part of the general machine shop on this floor, and fig. 8 is a view of the assembly shop for the sensitive and delicate control coils for a variety of relays for definite- and inverse-time operations. The relay department is fully equipped for the manufacture and assembly of the necessary time pieces. Of particular interest in this direction is the construction of minute governors used for the speed control of the time-regulation apparatus on some of the time relays. These perfectly-constructed devices are provided with balls and straps and are hand assembled.

A third floor is equipped with some miscellaneous machinery not without interest. An engraving machine deals with the scale plates, &c., of instruments intended for use in tropical countries. The engraving is filled in with wax, after which the scales are treated in the plating department on the next or top floor, which is equipped with apparatus for nickel, copper, silver and gold finishing. The latter treatment is given to the "tropical" instruments, and the silver process is used for the fine contacts of relays, &c. It was encouraging to note at the time of our visit that the departments were fully employed, and that optimism prevailed among the staff and workpeople.

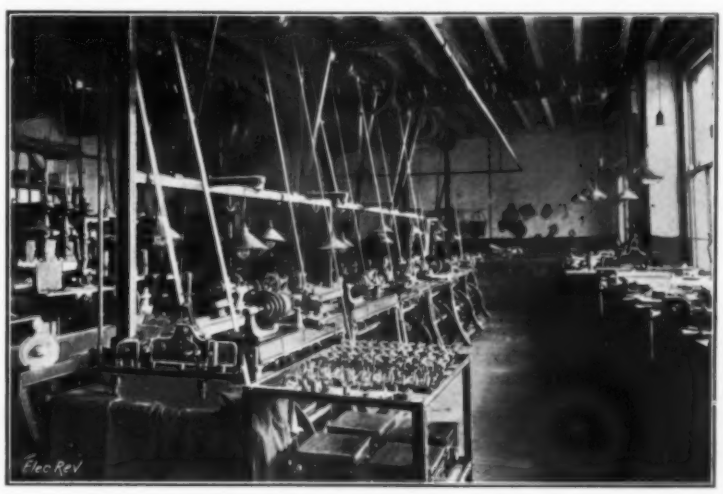


Fig. 8.—Relay-Assembly Shop.

The Birmingham Broadcasting Station.

The New Studio and Relay Automatic Telephones.

THE new studio which the British Broadcasting Co., Ltd., has provided at its Birmingham radio-telephone broadcasting station, besides being the largest in this country, is of interest on account of the improvement that has been adopted for controlling echo effects. In contrast to the old method of completely draping the room so as to eliminate all echo, fig. 1 shows that one of the chief features of 5IT's new studio is ample window space, which should incidentally facilitate natural lighting and ventilation. A certain amount of echo, regulated to suit the kind of music being played, enhances the quality of transmission, and accordingly the draping has been hung on pulleys so that it may be varied at will. The area of the main studio is some 2,000 sq. ft., and since the opening of the new studio on January 20th the new control arrangements have effected quite an appreciable improvement in the quality of transmission. This is true especially of what may be termed the heavier types of transmission, in which the microphone has to deal with a volume of sound made up of many widely differing parts. The exceptionally wide floor space in the main studio has enabled a more effective distribution of the parts of a band, or choir, to be made; but as was to be expected, the large studio has been found not so suitable for speech and solo musical items as the smaller studio, from which most of the talks and some of the lighter music will be transmitted.

It is also of interest to note that the new studio and office accommodation has been equipped with a Relay automatic telephone branch exchange of the latest type, as shown in fig. 2. The installation, which is initially one of 30 lines, is constructed on the expanding bookcase principle, so that additional units can be added as required. The exchange not only interconnects every department of the building, but it also establishes communication with the manual switchboard for outgoing and incoming public exchange calls. With this Relay combination service, only one telephone is used to get the automatic internal calls as well as the ordinary Post Office calls, and gives a continuous day and night automatic service throughout the Birmingham station. The Relay Co. has also received a requisition for a similar installation at the B.B. Co.'s Cardiff station.

Fig. 1.—A Corner of the Main Studio at Birmingham.

Fig. 2.—Relay Automatic Telephone Exchange at "5IT".

Fig. 3.—Part of the Broadcasting Control Room.

Tramway and Railway Notes.

(*Continued from page 218.*)

Irish Free State.—DUBLIN.—According to the *Daily Telegraph*, the Dublin Borough Commissioners have sanctioned an agreement under which, in consideration of the Corporation undertaking not to exercise for 42 years its right to purchase the city portion of the Dublin United Tramways, the latter company will take over and work the Dublin and Lucan Electric Railway.

London.—MORDEN TUBE EXTENSION.—The Underground Company has placed contracts for the construction of South Wimbledon station and Collier's Wood station on the new Morden Tube extension. Of the seven stations on the line, six are now in course of erection, and it is anticipated that the line will be ready for traffic in the summer. Work has also commenced in the construction of the Tooting Broadway, Balham and Trinity Road stations, and they are scheduled to be completed in five months' time. Good progress is being made with the rest of the work. About 25 per cent. of the permanent way has been laid and the installation of signals, &c., is now in hand.

LOTS ROAD STATION.—Work is in hand to enable the Central London Tube, now dependent upon the Wood Lane power station for most of its supply of energy, to be fed entirely from the power house at Lots Road, Chelsea. The existing steam plant at Wood Lane is now obsolete and inefficient. Cables from the Lots Road station have been laid already, and in view of the different voltage of the h.p. supply on the Central London Railway, a transforming station is being installed in the Wood Lane power house, which will thus become a distributing centre for the railway. Additional plant also is being installed at Lots Road to provide for the further demand which will be made upon its output by the Central London Railway and other increased services and extensions.

TOTTENHAM COURT ROAD STATION.—The merging of the Central London and Hampstead line stations at Tottenham Court Road is approaching completion. The escalator equipment, part of which was put into service a month or so ago, has been completed, and was put in operation on February 1st. The work of demolishing the eight lifts which have hitherto served the station and the construction of the new entrance and subway leading from the site of the Central London station will not be completed until April 1st. The concourse at the foot of the main escalator, which includes the whole of the space formerly occupied by the four lifts, will, when completed, be the largest in London, providing ample accommodation for the traffic to be dealt with. The number of trains to be operated through the four platforms at Tottenham Court Road will be 1,804 per day. The cost of the improvements will exceed £100,000.

Lytham-St. Annes.—SERVICE TO BE DISCONTINUED.—The Corporation Tramways Committee has recommended the Town Council to discontinue the tramway service between Lytham Square and the hospital, and substitute motor coaches.

Newcastle-on-Tyne.—PURCHASE SCHEME REJECTED.—In connection with the Corporation's decision to purchase the Tyneside Tramways and Tramroads Co.'s undertaking for £118,000, this and other proposals were submitted to a town's meeting, and the result being unsatisfactory, a poll of the citizens was taken, which resulted in the rejection of the proposed purchase.

Telegraph and Telephone Notes.

Argentina.—TELEPHONE SERVICE.—Direct telephone communication between Bahia Blanca and Buenos Aires has lately been established. The service is a source of great satisfaction to all commercial houses, and has already proved a great saver in time.

Japan.—AUTOMATIC TELEPHONY.—The restoration of the Tokio telephone service, which was destroyed by the earthquake and fire of 1923, should be completed at the close of the financial year 1926, by which time Tokio should possess nine automatic exchanges accommodating some 36,000 lines, in addition to manual exchanges with a further 46,000 lines. The automatic equipment is being made in this country by the Automatic Telephone Manufacturing Co., of Liverpool, and will be installed by it. The associated manual equipment is being made by the Standard Telephones and Cables, Ltd., of London. Japan has followed England's lead and has adopted the Strowger director system.

Marine Radio Operators.—STRIKE SETTLEMENT TERMS.—The Ministry of Labour stated on January 28th that it had obtained from the employers proposed terms of settlement of the strike of seagoing wireless operators, and had submitted them to the Association of Wireless and Cable Telegraphists, which was considering them.

Poland.—STRIKE.—The State telegraph and telephone operators at Warsaw struck work on January 26th, demanding the reinstatement of an employé. According to *The Times*, the telephone administration declares that the non-resumption of work will be treated as a dissolution of the working contract, and that no member of the staff will be re-engaged. A *Reuter* message, dated January 28th, stated that the efforts of the Minister of Labour to mediate between the strikers and the Administration had been unsuccessful.

STATE TELEPHONE SERVICE.—Owing to the prolonged dispute between the employés and the Warsaw Telephone Co., the Government has decided to enforce the law enabling the State to take over the administration of public utility services. The Minister of the Interior has, therefore, appointed M. Urbanowicz, a lawyer, administrator for the Telephone Co., in order to assure a normal service and safeguard the interests of the shareholders and the workers. The Government has also decided to appoint a commission composed of representatives of the Ministries of Justice, Industry, and Labour, to apportion responsibility for the dislocation of the service and to settle all differences. The telephone service will be restored at once. —*Reuter* (Warsaw).

Rugby Radio Station.—PUBLIC SERVICE.—It is announced by the Post Office that on and from January 30th radiotelegrams will be accepted at any postal telegraph office for transmission to ships *via* the new wireless station at Rugby, which will enable a direct service to be offered to ocean liners and other ships fitted with continuous-wave receiving apparatus at any point on the high seas, however remote. Rugby will send daily to ships out of range of the British stations by which the regular ship and shore service is conducted, a list of the ships for which messages are in hand, indicating the order in which they will be sent. The rate will be 1s. 6d. per word.

Ship-Shore Radio Telephony.—G.W.R. TESTS.—Mr. D. B. S. Shannon recently tested what he claims to be improved apparatus for communicating by radio-telephony between a ship at sea and the shore without the use of either aerial or earth connection. The experiments were made on board one of the Great Western Railway Co.'s Channel Islands steamers; an ordinary telephone instrument was used in connection with a portable radio transmitter, and conversation is stated to have been clear over distances of from 10 to 70 miles. The ship's radio operator was able to transmit two messages with the ship's apparatus simultaneously without interference. This duplex outfit is said to consist of a 3-valve receiver and 2-valve transmitter, which can be combined in one case. The device is claimed to be specially suitable for aircraft.

Radio Notes.

Austria.—NEW STATION.—The President of the Austrian Republic, M. Hainische, inaugurated the new broadcasting station at Rosen Huegel, near Vienna, on January 30th; it is said to be one of the most powerful in Europe, and is operating on a wave-length of 500 metres.

According to *The Times*, a wave-length has been apportioned to the new station for the time being only, and is liable to be altered when the International Union at Geneva is ready to allocate new wave-lengths. In any event Vienna may possibly broadcast for some weeks to come simultaneously on two wavelengths.

Broadcasting Committee.—FINAL PUBLIC SESSION.—The Government's Select Committee on Broadcasting held its final public session for the hearing of evidence this week in London.

Ceylon.—NEW STATION.—New transmitting plant designed for both ship to shore commercial work on i.c.w. and c.w. and broadcasting was inaugurated in December by the Governor of the island. The plant was designed by the chief engineer of the Post Office (Mr. E. Harper, M.I.E.E.) and erected by the Department. The power in the oscillatory circuit for broadcasting is 1 kW, which can be increased later as required. Excellent reports regarding the transmission have been received from places as far distant as Calcutta, India, approximately 1,000 miles distant. The broadcasting service in Ceylon is conducted by the Post and Telegraph Department.

Chile.—TWO NEW STATIONS.—The Chilean Government has granted a concession to the Compania Radio Chilena, of 30 years' duration, in conformity with the stipulations of the electric service law, and the company is therefore obliged to install two retransmitting stations in the zones which the Department of Electric Services indicates. One will be located in Concepcion, about 220 miles in a direct line south of Santiago. The entire system must be in operation by June, 1926, says *Commerce Reports*. The station at Santiago, which is to be rated at 1,500 watts, will broadcast on a 480-metre wave-length and will have the call letters CMAB. It will be permitted to broadcast four hours daily. It has been estimated that there are now 25,000 receiving sets in use throughout the Republic.

Holland. — WIRE RELAYS. — The Hague Town Council accepted on February 1st, says *The Times*, the proposal to use the ordinary telephone service as a means of broadcasting, as outlined in this column last week.

International Long-distance Tests.—TRANSATLANTIC EXPERIMENTS.—The week of international radio-telephone tests which have been conducted between England and the European Continent, on the one hand, and North and South America, on the other, do not seem to have been as successful as was expected. The pre-arranged schedule of transmission announced by the International Radiophony Bureau at Geneva was an indication of the international co-operation that has been reached, and amateur reception was relied upon to a large extent. Unfortunately, however, S.O.S. calls from ships

at sea silenced American Atlantic coast stations on two nights, while atmospherics, the Aurora Borealis (seen in France and Norway, which interfered with telegraph communication in Scandinavia) and sun spots have all been blamed. Reports from the U.S.A. indicate that experimenters seem to think that European broadcasting stations are not sufficiently powerful for more than fragmentary reception across the Atlantic Ocean. Although useful in their way, the tests serve to emphasise the fact that long-distance broadcasting is as yet unattainable as a means of entertainment.

Japan.—STATIONS.—According to a report by the Director of the Japanese Bureau of Telegraphs in Tokio, there are now three broadcasting stations in operation in Japan, *viz.*, at Tokio (call signal JOAK, wave-length 375 metres), Osaka (JOBK, 385 metres), and at Nagoya (JOCK, 360 metres). An experimental broadcasting station (JQOK) has also lately been established at Dairen, in Corea.

Paraguay.—BROADCASTING STATION SITE.—A site has been awarded in the centre of Asuncion on which it is proposed to construct a large broadcasting station. The construction will be under the control of the Ministry of War and Marine, which will purchase equipment by means of public tenders. The opportunity will be taken to organise a broadcasting company under the management of the Municipality of Asuncion.—*Reuter's Trade Service* (Asuncion).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia. — MELBOURNE. — March 8th. City Council. Totally-enclosed armoured-type switchgear. April 27th. 2,000-kW rotary converter, and switchgear with accessories, and a.c. control gear. Specifications from City Electrical Engineer's Office.

SYDNEY.—February 10th. New South Wales Government Railways. 100 40-h.p. traction motors; March 3rd, 101 electric car equipments, consisting of motors, control equipments, air compressors, pantographs, &c.; April 14th, one 5-ton fixed electric crane. Forms of tender from Chief Mechanical Engineer, Wilson Street, Redfern, Sydney.

February 17th. 1,500-V, d.c. switchgear for St. Leonards and Hornsby sub-stations; March 3rd, 11,000-V ironclad switchgear for St. Leonards sub-station; March 10th, stokers or pulverised fuel equipment for three water-tube boilers for White Bay power house. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

Municipal Council. February 15th. Twenty transformer tanks. February 8th. L.p. cables. Specifications from the Construction Engineer, Electricity Department, Town Hall, Sydney.

March 2nd. Australian Gas Light Co. One 750-kW turbo-generating set. Specifications from the Engineer, Parker Street, Haymarket, Sydney.

Aylesbury.—February 16th. Electricity Department. Overhead 11,000-V transmission lines and cables. (January 22nd.)

Bedwas.—February 11th. Bedwas and Machen U.D.C. Electricity Department. H.p. transmission line, l.p. distribution. h.p. and l.p. switchgear and static transformers. (January 29th.)

Belfast. — February 20th. Electricity Department. Twelve months' supply of stores, &c., including electrical accessories, lamps, carbon brushes, electricity meters, &c. (January 29th.)

Cardiff. — February 22nd. Electricity Department. Twelve months' supply of paper-insulated cables, one 1,500-kW rotary converter, and one 2,000-kW ditto.

March 8th. One 10,000-kW turbo-alternator and condensing plant. (See this issue.)

Chesterfield.—February 13th. Electricity Department. One 1,000-kW rotary converter equipment. (January 29th.)

Clitheroe.—February 23rd. Corporation. Transformers, switchgear, and cable connections for sub-station; e.h.p. and l.p. cables, boxes, &c. (January 15th.)

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or, alternatively, one 20,000-kW turbo-alternator with condensing plant. (See this issue.)

Faversham.—February 12th. Electricity Department. Cables. (January 29th.)

Halifax.—February 20th. Markets and Parks Committee. Electrical engineering work in connection with the erection of the public abattoirs. Particulars from Borough Engineer, Crossley Street.

Hull.—February 15th. Tramways Committee. Stores required during year ending March 31st, 1927, including car-lighting fittings, lamps, cable, and switches. Form of tender, &c., from General Manager, Tramways Offices, Albion Street, Hull.

Kilmarnock. — Ayrshire Electricity Board. Supply, delivery, and laying of h.p. cables and ducts in the Burghs of Ayr and Prestwick, also transformer kiosks and section pillars. (January 22nd.)

London.—HAMMERSMITH.—February 10th. Electricity Department. Stores for 12 months, including electric light sundries, insulated wire, joint boxes, meters, l.p. cables, &c. (January 22nd.)

ISLINGTON.—February 8th. Electricity Department. One 10,000-kW, 3-phase turbo-alternator, condensing plant, condensate, circulating, exhaust, steam and water pipes, &c. (January 22nd.)

METROPOLITAN WATER BOARD.—February 8th. 12 months' supply of electric lamps. Forms of tender from the Chief Engineer, 173, Rosebery Avenue, E.C.1.

LONDON COUNTY COUNCIL.—February 22nd. H.p. switchgear for Lewisham tramway sub-station. (January 22nd.)

ST. PANCRAS.—March 2nd. Electricity Department, E.h.p. switchgear at the Grafton Road sub-station. (See this issue.)

Manchester.—February 16th. Tramways Committee. Permanent-way points, tongues and crossings and general stores. Schedules from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly.

Newark-upon-Trent.—February 10th. Electricity Department. E.h.p., medium, and l.p. mains and distribution network, with street-lighting mains and accessories, single- and three-phase house-service pattern meters, two 250-kVA transformers, e.h.p., 11,000-V switchgear. (January 22nd.)

March 1st. Corporation. Two electrically-driven centrifugal pumps. (See this issue.)

New Zealand.—WELLINGTON.—Public Works Department. April 6th. Storage battery, motor generator, and switchboard for the Penrose sub-station.*

March 23rd. Five oil filters, 5 oil-testing equipments, and 5 filter-paper drying ovens.* 22,000-V switchgear and equipment for Penrose sub-station.*

Northern Ireland.—BELFAST.—February 8th. London, Midland & Scottish Railway Co. (Northern Counties Committee, Ireland). Stores required during 12 months. Particulars from Mr. F. J. Martin, Stores Superintendent, York Road station, Belfast.

Perth.—February 17th. Corporation. Electric lighting installation at 84 houses. Plans from Burgh Surveyor.

Plymouth. — February 17th. Electricity Department. Twelve months' supply of electricity meters, cables and transformers. (January 29th.)

Retford.—February 19th. East Retford Gas, Water and Electricity Department. Electricity generating plant, mains, transformers, and meters. (January 22nd.)

Salford.—February 18th. Electricity Department. Coal supplies required during six months commencing March 1st, 1926. Particulars from Borough Electrical Engineer, Frederick Road, Salford.

South Africa.—JOHANNESBURG.—February 25th. Municipal Council. Four d.c. switchgear panels and 3-phase, truck-type ironclad switchgear panels.*

February 25th. S.A. Railways and Harbours. Two 4-ton electrically-driven fixed wharf cranes for Luderitz jetty.*

One 7-ton and five 4-ton electrically-driven portal cranes, complete.*

PRETORIA.—February 25th. Postmaster-General's Department. Supply of a manual telephone exchange for Hatfield, Pretoria. Controller of P.O. Stores, Pretoria.

February 25th. Union Tender Board. Miscellaneous telegraph and telephone materials (C×1880).*

Spain.—Ministro de Fomento. Four electric cranes for the port of Gijon Musel. Particulars from Ilmo. Señor Presidente de la Junta de Obras del Puerto de Gijon.—*Reuter's Trade Service* (Madrid).

Stockton-on-Tees and Thornaby.—February 6th. Joint Tramways Committee. Pinions, axle boxes, &c. Particulars from General Manager, Bridge Road offices, Stockton-on-Tees.

Sutton Coldfield.—February 17th. Electricity Department. E.h.p. underground main, rotary converting plant and switchgear and automatic rotary converting plant and switchgear, or mercury-arc rectifiers. (See this issue.)

Watford.—February 23rd. Board of Guardians. Electric lighting installation, consisting of wiring old buildings, new power mains, motors, main switchboard, &c. Specifications from the Master's office, 60, Vicarage Road, Watford, or from the consulting engineer, Mr. W. M. Benny, 39, Carlton Road, Putney, S.W.15.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Admiralty.—
Gasfilled and vacuum lamps.—Edison Swan Electric Co., Ltd.; and Metro-Vick Supplies, Ltd.

Barking Town.—Electricity Committee. Accepted:—
Crane at transformer house (£117).—Herbert Morris, Ltd.

Brighton.—Lighting Committee. Accepted:—
Cast-iron tubes and specials for condensing system at Southwick (£790).—Stanton Ironworks, Ltd.
Cable (£4,695).—Macintosh Cable Co., Ltd.
Steel bar work for coal plant (£566).—Indented Bar & Concrete Engineering Co., Ltd.
80-h.p. motor (£340).—Metropolitan-Vickers Electrical Co., Ltd.
Circulating pump (£288).—W. H. Allen, Sons & Co., Ltd.
Switchgear (£74).—Brookhirst Switchgear, Ltd.
Reconditioning battery (£222).—Tudor Accumulator Co., Ltd.

Chile.—The City of Santiago having accepted the specification for "Holophane" refractors for street lighting, the contractors for the installation (the International General Electric Co.) have placed an order for 10,000 refractors with Holophane, Ltd., of London.

Eastbourne.—Electricity Committee. Accepted:—
Cable (£6,290).—Craigpark Electric Cable Co., Ltd.

Hebden Bridge.—Education Committee. Accepted:—
Installation of electric lighting in board room and offices, Pitt Street.—G. A. Cotton.

Kidderminster.—Committee of Management, Kidderminster and District General Hospital. Accepted:—
Installing electric light in the new building.—B. French.

London.—LONDON COUNTY COUNCIL.—Accepted:—
2,000-kW rotary converter for the Elephant sub-station (£7,134).—British Thomson-Houston Co., Ltd.
Wiring and fitting houses at East Hill housing estate (£1,083).—Smethurst and Co. (London), Ltd.

Sheffield.—Electricity Supply Committee. Accepted:—
10,000-kW turbo-alternator (£30,051).—C. A. Parsons & Co., Ltd.
36 h.p. switchgear panels and 6 h.p. sub-station panels (£5,000).—A. Reyrolle & Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted:—
Spare rotor (£3,752).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear (£3,870).—A. Reyrolle & Co., Ltd.
Control gear, &c. (£3,801).—South African General Electric Co., Ltd.
300-amp. Edison battery (£420).; 375-amp. ditto (£533).—Associated Engineers Co., Ltd.
Two 3-phase regulators (£470).—South African General Electric Co., Ltd.
Motor pump and tank (£188).—Drysdale & Co., Ltd .
Three sets single-phase regulators (£377 per set).—South African General Electric Co., Ltd.

Worthing.—Electricity Committee. Accepted:—
H. and l.p. cables (£10,266).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Question and discussion evening.
Friday, February 12th. Lecture on "A Visit to Some Power Stations in the U.S.A. in 1925," by Mr. W. H. Patchell.
Saturday, February 13th. At Holborn Hall. From 7.30 to 11 p.m. Annual dance.

Association of Engineering and Shipbuilding Draughtsmen (Birmingham Section).—Wednesday, February 10th. At the Chamber of Commerce, Birmingham. At 7.30 p.m. Lecture on "E.h.p. Switchgear," by Mr. G. L. E. Metz.

Institution of Heating and Ventilating Engineers.—Wednesday, February 10th. At the Holborn Restaurant. At 2.30 p.m. Annual general meeting. Paper on "Engineering Services in Hospitals and Asylums," by Mr. H. G. Cathcart. 7 p.m. Annual dinner.

Institution of Electrical Engineers.—Thursday, February 11th. At the Hotel Cecil, Strand, W.C.2. At 7 for 7.30 p.m. Annual dinner.
Monday, February 8th. At 7 p.m. Informal meeting. Discussion on "Modern Applications of Ball and Roller Bearings," to be opened by Mr. R. J. Mitchell.
(North-Eastern Centre).—Monday, February 8th. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "An All-Electric House," by Prof. S. P. Smith.
(North-Midland Centre).—Tuesday, February 9th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Informal discussion on "How Can the Cost of Electrical Distribution be Cheapened?"
(Scottish Centre).—Tuesday, February 9th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "An All-Electric House," by Dr. S. P. Smith.
(South-Midland Centre).—Friday, February 12th. At the City Council Chamber, Birmingham. At 7 p.m. Joint meeting with the Civil and Mechanical Engineers. Address on "Road Transport and its Possible Developments." Speaker for I.E.E., Mr. C. O. Silvers.
(Dundee Sub-Centre).—Thursday, February 11th. At the University College, Dundee. At 7.30 p.m. Lecture on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.
(East-Midland Sub-Centre).—Tuesday, February 9th. At the College, Loughborough. At 6.45 p.m. Paper on "The Constants of an Electric Circuit," by Mr. R. C. Clinker.
(North-Western Centre, Students' Section).—Tuesday, February 9th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Joint debate with the N.W. Graduate Centre of the Institution of Mechanical Engineers.

Institution of Engineering Inspection.—Friday, February 12th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "The Application of Special Cast Irons in the Engineering Industry," by Mr. S. E. Dawson.

Electrical Engineers' Ball.—Friday, February 12th. At the Hotel Cecil, Strand, W.C.

British Electrical and Allied Industries Electrical Research Association.—Friday, February 12th. At the Savoy Hotel, Strand, W.C. At 1 p.m. Annual meeting.

Electrical Trades Commercial Travellers' Association.—Saturday, February 13th. At the Manchester Hotel, E.C. 6.30 for 7 p.m. First annual dinner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

MAGNOLLIUM sheets (a magnesium alloy).

A recently-patented British ironing machine for laundries.

TUNGSTEN arc lamp.

Notes.

The Electrical Arrangements at the British Industries Fair, Birmingham.—We have received, at the moment of going to press, a full programme of the events which will take place during the run of the Fair at Birmingham from February 15th to 26th. We shall publish this in our next issue, but we may state now that everything points to the Electrical Section being a great success. Some seventy electrical firms are preparing exhibits. One of the principal items in the programme is the visit on Wednesday, February 17th, of members of the Incorporated Municipal Electrical Association and other representative associations connected with the electrical industry. An official inspection of the Fair will take place, and the company will lunch together. The Electrical Contractors will pay an official visit on February 22nd, the Electrical Association for Women on February 23rd, and the Electrical Wholesalers' Federation on February 24th.

The Electrical Association for Women.—A course of six evening lectures of a practical and informative nature has been arranged specially for women working in the electrical industry as saleswomen, demonstrators, &c., and for domestic science mistresses and lecturers. The lectures are to be held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, W.C.2, at 7 o'clock on the following evenings:—February 9th, 15th and 22nd, and March 1st, 8th and 15th. The lecturers will include Mr. J. W. Beauchamp, director of the E.D.A., Mr. W. E. Bush, manager of the Lighting Service Bureau, and Miss Hodge. The course is free to members of the E.A.W., and for non-members the fee is 7s. 6d. for the course and 2s. for single lectures.

The Electro-Harmonic Society.—PRESENTATION TO MR. W. E. LANE.—On Wednesday last week, a meeting of the subscribers to a testimonial to Mr. W. E. Lane was held at the Institution of Electrical Engineers under the chairmanship of Sir George Sutton, Bart. Opening the proceedings, Sir George read letters of apology from a number of distinguished members of the Society who were prevented from attending. The hon. treasurer of the Testimonial Fund, Mr. J. E. Kingsbury, said that subscriptions ranging from five guineas to five shillings had been received, making a total of £87 18s.; many of the members also wrote letters expressing their pleasure in subscribing. Delay in holding the meeting had arisen from the illness of Mr. Lane last year, and also from his own illness. Mr. Lane had chosen that the testimonial should take the form of a cabinet and a wireless receiving set.

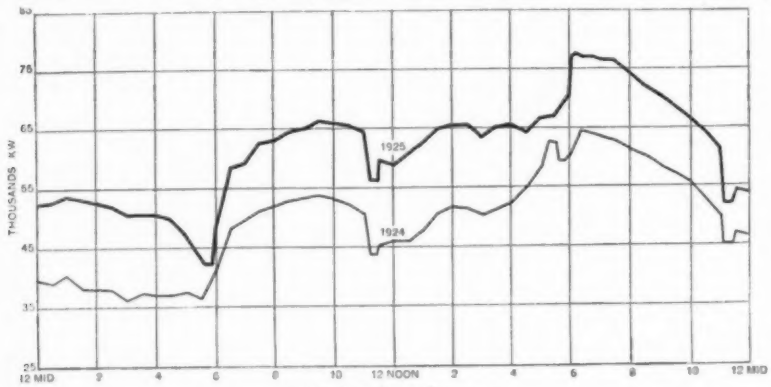
Sir George Sutton then addressed the meeting, expressing high appreciation of the services rendered by Mr. Lane to the Electro-Harmonic Society, and of the sterling qualities which he had displayed. Founded in 1886, the Society had filled a not unimportant place in the electrical industry. As one of the oldest members, he recalled some of the early days of the Society, when the meetings were held in the banqueting room of St. James's Hall in Regent Street; everybody knew everybody else then, for the industry was small compared with what it was to-day. They delighted in their own members' contributions—those of Alfred Izard and T. E. Gatehouse. Mr. Kingsbury was also a practical musician, and the other member of the "big four" was Mr. Henry Alabaster, who took charge of the business side. After twenty years had passed in the life of the Society a meeting was held, when Colonel Crompton made presentations to Messrs, Alabaster, Gatehouse, and Izard; now another twenty years had passed, and they were writing "finis" to its record. He thought it should not be beyond the ability of the younger generation to form a new society to look after the social side of the industry as the Electro-Harmonic Society had done. In 1901, twenty-five years ago, Mr. Lane became the honorary secretary; on behalf of the Society Sir George expressed the warmest appreciation of his long services, and he hoped the happiness which he had reaped was measured by the happiness of the members in being in contact with him. He was specially glad that a wireless set formed part of the presentation; Mr. Lane would sit and smoke and listen, and his thoughts would go back to the old days—to the violin of Gatehouse, the piano of Izard, and the companionship of his other old friends.

Mr. W. E. Lane said he could not believe that he deserved such a recognition; he had considered it an honour and privilege to serve the electrical community by carrying on the work which was begun by much abler men. Such success as had attended his efforts was due largely to the assistance and advice which he received from the committee and the executive committee, in which so many men of the highest eminence in the profession were enrolled. He was proud to feel that after nearly twenty-five years of continuous work he had gained their approval and esteem. To Messrs. Alabaster and Gatehouse he owed an immense debt of gratitude; they were his guides, philosophers and friends. Mr. Alabaster's great ability had made his work an easy task, and he was like a father to him: long might he live to enjoy the evening of his days. Mr. Gatehouse, unfortunately, had passed on; he was a man of high principles, brave, generous and genial, and keenly alive to the humorous. He was now in the Elysian Fields, and he hoped he was turning a benignant and approving eye on this gathering of his old friends and comrades. The mahogany cabinet was specially designed and built as part of his new house; and the wireless set was giving Mrs. Lane and himself infinite pleasure. Nothing could be more appropriate, and he

was deeply grateful for them. The Society was in a state of suspended animation, but its roots were alive, and the organisation was still available in London.

Mr. Sillar moved a vote of thanks to the Chairman, which Sir George briefly acknowledged.

Shanghai Electricity Undertaking Development.—We have received from the engineer-in-chief and manager of the Shanghai Electricity Department the load curves of the Riverside power station for December 29th, 1924, and the same day in 1925, which are reproduced herewith. Some idea of the influence of the very large industrial load on the station



Shanghai Load Curves.

can be gained from the curves. In addition to the lighting supply there is a very substantial heating load estimated at about 4,000 kW, but these two loads superimposed on the power load do not create a peak of any serious dimensions. It is interesting to note that the total kWh generated on the day of the 1925 curve amounted to 1,525,060, against 1,197,210 for the day of the curve for the previous year.

Old Liverpool University Students in London.—The second annual dinner of the Liverpool University London Society was held at the Florence Restaurant on Saturday, January 23rd, Prof. Reilly (Roscoe Professor of Architecture) presiding. Representatives of the University of Birmingham Guild of Graduates (London Branch) were present, and expressed a desire to run social events in co-operation with the L.U.L.S. The secretary, Mr. Harold Lloyd, 16, Blackheath Park, S.E.3, would be glad to hear from old Liverpool University students with a view to enlisting their co-operation.

Appointments Vacant.—Shift charge engineer for the Stafford Corporation Electricity Works. Electrical foreman (400 Rs. per month) for the South Indian Railway Co., Ltd. Two charge shift engineers (£376 and £292) for the Yorkshire Electric Power Co. Charge engineer for the North Met. Electric Power Supply Co. (See our advertisement pages to-day.)

Educational.—EAST LONDON COLLEGE.—Dr. R. L. Smith-Rose is delivering a course of six lectures (on Mondays at 6 p.m., commencing February 1st), on "Wireless Direction-finding in Theory and Practice" in the Electrical Engineering Department of the East London College (University of London). The fee for the course is 10s. 6d., but students of the engineering faculties of the colleges and institutions of the University of London can obtain free admission tickets on application. The lectures will be illustrated with lantern slides and will include experimental demonstrations.

EDINBURGH.—The Edinburgh University Court has approved of a recommendation by the Senatus that an honours half course in the mathematical theory of electricity should be instituted.

The Opening of Parliament.—The King opened Parliament on Tuesday last, and in the course of his speech touched on a number of matters with which Parliament will deal during the new session. Among these was a statement that invitations were being issued to the Governments of France, Belgium, Germany, and Italy to take part in a conference upon hours of labour in industry; a mention of the industrial revival which was being threatened by industrial troubles was made; the Government's electricity proposals received a passing mention; and among the other new measures forecast were those dealing with rating and the valuation of machinery in Scotland, national health and unemployment insurance, and the control of road vehicles.

Fatality.—An employé of the Leicester Corporation Electricity Department, Andrew Minto, 21, was killed at the Aylestone generating station on January 27th, another man narrowly escaping death. Minto and his companion both received shocks which rendered them unconscious. Minto was conveyed to the Royal Infirmary, but on arrival there was found to be dead. Artificial respiration was resorted to, with successful results, in the case of his workmate. The two men were engaged in working an electric drill at the Corporation power station.

An inquest was held at Hampstead on February 1st on Mrs. M. Kleeman, who was found dead in a bath. When Mrs. Kleeman was discovered a pair of slippers were alight beside the electric radiator in the bathroom. Mr. J. Leadbeater, electrical engineer to the Borough Council, said the stove showed signs of overheating and was fused. He was of opinion that the slippers burned off some of the insulation from the wire and allowed the metal frame to become electrified.

Television.—Mr. J. L. Baird claims, according to the daily Press, to have invented apparatus which makes both wire and "wireless" television possible. He is reported to have said: "I do not transmit photographs, or want to; that has been done long ago. I transmit whatever comes before the transmitting end of my apparatus, its movement and form, with full detail. Television stands in the same relation to movement as broadcasting does to sound." Application is said to have been lodged with the Postmaster-General for permission to establish "television broadcasting stations in different parts of the country," and it is stated that a company has been formed to market the receiving devices, or "televisors." Such claims must be treated with caution, but it seems that the inventor's theory is to project an image of the object to be transmitted in a piecemeal fashion upon a light-sensitive appliance by means of a multitude of lenses which rotate in such a manner as to focus each momentarily on one part only of the object to be transmitted; owing to the retentivity of vision the successive "area" images appear simultaneously to the eye when thrown on to a ground-glass screen. The light-sensitive device must respond instantaneously to very small quantities of light, and it is declared that the face can be "clearly transmitted, not as a mere black and white effect, but with graduations of light and shade, and the detailed features are readily recognisable at the receiver; all movement is faithfully portrayed."

The Batti-Wallahs' Society.—On Wednesday last week Sir Hugo Hirst was the guest of the Batti-Wallahs' Society, at a luncheon held at the Hotel Cecil. Invited to address the gathering by the President, Mr. Pooley, Sir Hugo said much publicity had been given to his views regarding the conception of the scheme outlined by the Prime Minister, but he reserved the right to criticise it when the actual scheme was put forward. The idea of developing electricity on a more suitable basis than had obtained during the past 30 years was very welcome; in future it would be national rather than parochial, but they must use all their experience and judgment in formulating helpful criticism, so that they would go right this time. Soon after the War he had stated that the damage done by the War could only be finally repaired if this country adopted a policy of cheap electricity supply; he was not thinking of 60 super-stations, but that they had endless sources of waste power which they ought to utilise. The coal situation should be cleared up first; there was plenty of material available to satisfy both owners and miners, and in his opinion it was not likely that there would be a strike. With the assistance of a great mine owner, a working miner, and a financial authority, he had made a very careful study of the position, and he thought that the subsidy could not be stopped in the case of pits where it was otherwise impossible to pay the miners' minimum wage; the hours of work here differed but little from those worked abroad, but some miners took 40 minutes walking to their work, and by the adoption of electric haulage underground they could save 20 minutes each way and thus obtain a greater output. The State should acquire the royalties and pay for them by annuities; afterwards the royalties should be regulated in accordance with the thickness of the seams. The demand for payment for way-leaves underground was mere blackmail. The immobility of labour should be remedied; at present in some places miners were unemployed, whilst in other districts they were unobtainable, though work was available for them. There was no system of storing coal except in private ownership, and this should be put right. He believed that the coal industry could be reorganised on a paying basis, and that no one need give up anything, nor need there be any charge on the State. The fundamental mistake was that they had not made half enough use of electricity in their mines. Sir Hugo held that the mines should be organised in groups; a central power station should be erected for each group, and electrical haulage, coal-cutters, and other electrical equipment should be used in the mines. The coal should be properly cleaned before distribution, and the rubbish that was discarded should be burnt in the boiler furnaces. It was estimated that from this waste material every group could send 25,000 kW at least into the national network. They should extract all the by-products, and produce electricity at less than ½d a unit as a surplus product. In addition to this waste fuel they should use blast-furnace gases and all other sources of waste heat. Unless they made use of their advantages in this respect they could not get cheap power—certainly it could not be done by erecting big super-stations all over the country. Cheap electricity would give them the all-electric age; they must all work with one common aim, but they must see that they had the right kind of electricity scheme.

Coal and electricity must be combined, but he hoped it would never be done under a scheme of nationalisation.

Proposing a vote of thanks to the speaker, Mr. G. W. Partridge commended the broadminded way in which Sir Hugo had approached the question, and said he hoped that those in authority would be equally broadminded and business-like. He entirely agreed with Sir Hugo as to the recovery of by-products and the grouping of mines, provided that it did not mean nationalisation. He agreed also that the desired cheap supply was not obtainable by erecting power stations all over the country. Sir Hugo had shown extreme knowledge of the subject and had adopted a common-sense view.

A 3,280-h.p. Electric Locomotive.—The Brown-Boveri Co., of Baden, Switzerland, has recently delivered the first of two powerful electric locomotives to the Paris-Orleans Railway Co. for use on the electrified section of its line between Paris and Brive, a distance of 330 miles. It is claimed that the engines, which have a rating of 3,800 h.p. and can attain a maximum speed of 87½ m.p.h., are the most powerful so far built in Europe. The following are the chief characteristics of the engines, which are designed to utilise d.c. at 1,500 volts:—Maximum tractive capacity at wheel rims, 21 tons 12 cwt.; normal ditto, 14 tons; weight of mechanical portion, 75 tons; weight of electrical equipment, 43.6 tons; number of electric motors, four; hourly capacity per motor at 1,350 volts, 950 h.p. at 510 r.p.m.=41 m.p.h.; hourly capacity per motor at 1,500 volts, 1,050 h.p. at 565 r.p.m.=45 m.p.h.; continuous output per motor at 1,350 V, 790 h.p. at 555 r.p.m.=44.7 m.p.h.; continuous output per motor at 1,500 V, 875 h.p. at 615 r.p.m.=49 m.p.h.; driving wheel diameter, 5 ft. 9 in.; gear ratio of drive, 1—2.55; overall length between buffers, 58 ft. 2 in. The machine, which is slightly conical in outline, has four pairs of centrally located driving wheels and a four-wheel bogie at the front and rear. Each pair of driven wheels is separately driven on the Buchli system, while the bogie design is that of the Swiss Locomotive and Engineering Works, of Winterthur, which was responsible for the mechanical portion of the engines. Each of the motors is provided with a fan for cooling purposes, and centrally located in the motor compartment is a main grouping switch by means of which the motors can be grouped either in series, partly series-parallel, or in parallel. The starting resistances are mounted on the roof of the engine. The engines are arranged to be driven from either end, and as they are intended to be used on both overhead and third-rail sections of the Paris-Orleans railway, they are provided both with two pantograph-type trolley arms and sliding shoes, the latter being mounted on wooden carriers supported on the front and rear bogies.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the informal meeting on January 25th Mr. C. Lipman was in the chair, when Mr. H. W. Clothier opened a discussion on "Impressions of my Visit to America, mainly about Switchgear." He used a number of lantern slides to show large power stations, machines, control gear, distribution lines, &c., and said:—

"My salient impression of Canada and the United States is the largeness of the demand and consequent development of large plant. The degree of comfort in living seems to be gauged by the quantity of electrical appliances to be found in the homes. There is no scarcity of information about the public service: each undertaking issues a plentiful supply of literature. This progressive spirit creates plant which appears very large when compared with our own. Thirty or forty thousand kW turbines, which are exceptional to us, are common to them; fifty to sixty thousand kW sets are numerous; a seventy-five thousand kW steam set is on order, and a 100,000-kW design is contemplated. At Chippawa, the Hydro-Electric Commission of Ontario, the largest power station I saw, had eight 50,000-kW sets, and there is room for another, making altogether 450,000 kW in one building. Steam power stations of 250,000 kW are common, and future schemes include stations of 600,000 kW.

"On one system there are about 100 stations operating in a densely loaded area, and 30 to 40 men were engaged solely on routine examination and cleaning. In the regular quarterly round every important circuit breaker is disconnected, overhauled, cleaned, lubricated, checked, and put into service.

"How many of our undertakings have gangs of experienced fitters regularly going round to overhaul the switchgear? Supposing they were introduced, would they not in time tend to become mechanical time servers, making jobs, possibly creating accidents? My own view is that switchgear should be made sound in the first instance, with all vital parts covered up, with bolts, cotters, &c., that will not loosen, bearings that cannot rust up or jam, and then it is best left alone, just as a cable and underground joints are left.

"As a further precaution against insulation failure, users install apparatus with a greater safety factor; in important situations, at least, the installed switchgear voltage rating is higher than the normal working voltages, for instance, one finds 25,000-volt switchgear in use in power stations working at 13,500 volts. Motor-operated induction regulators are used on the 2,300/4,000-volt radial feeders, and automatic re-close circuit breakers restore the circuit automatically. A special relay is used to prevent re-closing on a bad short circuit, but otherwise the breaker would close twice and then lock out; 50 per cent. of the faults are cleared at the first shot, 25 per cent. at the second, and the remainder locked out, the time interval increasing successively; for example, 5 seconds, 20 seconds, and 40 seconds.

"It is apparent that circuit breaker design is not yet stabilised, but most breakers of from 750,000 to 1,500,000 kVA breaking capacity are enclosed in steel tanks which are grounded. Sundry features indicate an endeavour to increase the breaking capacity of circuit breakers. We think of the diversity of designs in use at home, but of 10 large stations no two were exactly alike in respect to circuit breaker construction.

"Coming from the Tyneside, where the lighting is reasonably steady, where there are practically no reactances, and where the network is all solid, one cannot help speculating to what extent American engineers have been forced to the extensive use of regulators and their accompanying complication of switching and regulating, by the greater use of reactances and the system of radial feeders. It was said at one place that without the regulators they could not guarantee the voltage at consumers' terminals within 12½ per cent."

Mr. H. Trencham, Mr. A. F. Harmer, Mr. Ferguson, and Messrs. R. C. Anderson, G. M. Davies, M. D. Hart, D. Kingsbury, and C. Lipman and Lt.-Col. K. Edgcumbe also spoke.

Junior Institution of Engineers.—Mr. F. Forrest, assistant city electrical engineer of Birmingham, speaking on Friday last at the annual dinner of the Midland Section of the Junior Institution, observed that the members would be particularly interested in the Government's electricity scheme, because the Birmingham supply was of a non-standard frequency. If, as they anticipated, 50 cycles was to be the standard, the whole of their plant had to be scrapped, a matter of enormous expense for the city. It was undoubtedly a great pity that the subject had become a political one.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

The marriage took place at Accrington, recently, of Miss GLADYS HORROCKS, elder daughter of Mr. T. Horrocks, of Accrington, and M. ALBERT L. J. JOLY, who is employed at the Paris City Council electrical power station.

Mr. J. B. WOODYATT has been appointed president of the Southern Canada Power Co., in succession to the late Mr. W. C. Hawkins. He will continue to act as general manager of the company.

We regret to learn that Mr. J. V. MOINET, burgh electrical engineer, Hamilton, is seriously ill.

Mr. S. O. ALLEN, telephone traffic superintendent, of the Southampton district, who is leaving to become district manager of the Mid-Lancashire district, has been presented by the staff with a wireless set, and his wife with some plate.

After a service of almost 21 years with Newcastle-on-Tyne Corporation, Mr. ERNEST HATTON, engineer and general manager of the city tramway system, has tendered his notice to the Corporation Transport and Electricity Committee. He has been in poor health for nearly a year.

Mr. A. EBBINGTON, assistant works manager to Marconi's Wireless Telegraph Co., Ltd., of Chelmsford, who is leaving after 19 years' service, has been presented by the staff with a silver salver and a silver cigarette box.

Last week the staff of the District Manager's Office, N.W. Telephone District, entertained Mr. WHITELAW, district manager, to dinner, prior to his transfer to the district managership at Manchester. He was presented by the staff with a gold wristlet watch; and Mrs. Whitelaw with a case of fish eaters.

Mr. G. C. DEELEY, of the Southport electricity station, has resigned. His successor will be Mr. ALFRED E. KNIGHT, of Great Yarmouth.

Mr. G. F. HARE has relinquished his connection with Messrs. David Shanks & Co., Ltd., and has joined Messrs. Smith and Ansell, Ltd., of Birmingham.

Sheffield Electricity Committee has appointed Mr. S. R. BAINBRIDGE as assistant mains engineer at a salary of £319 per annum.

The Macintosh Cable Co., Ltd., announce that Mr. C. H. HAMPSON has just been appointed their sales manager.

Mr. W. J. COTTERELL, M.I.Mech.E., was to sail for South Africa on January 29th, by the *Walmer Castle*, in connection with the important contract recently awarded to International Combustion, Ltd., by the South African Electricity Commissioners for the power station at Congella, Durban. Communications may be addressed to him, c/o Dowson and Dobson, Johannesburg.

Mr. WILLIAM BLOGG, lately sales manager of the Sterling Telephone & Electric Co., Ltd., has now joined Messrs. Alfred Graham & Co., and shortly will be leaving this country for a business tour in the East and Australasia. Any communications addressed to St. Andrew's Works, Crofton Park, London, S.E.4, will be forwarded to Mr. Blogg.

The marriage of Major G. C. MILNES, M.C., M.I.E.E., borough electrical engineer of Lancaster, to Rosie, second daughter of Mr. and Mrs. W. French, of Windsor, was the occasion of an interesting ceremony on January 26th, when Major Milnes was presented with an oak revolving bookcase and rose bowl, subscribed to by the whole of the employés of the Corporation Electricity Department.

Obituary.—MR. D. MCCOLL.—The death occurred at Seaford, Sussex, on January 20th, of Mr. Donald McColl, formerly manager of the Shanghai Tramways. He was 52 years of age.

MR. G. H. PEARSON.—The death occurred recently of Mr. G. H. Pearson, traffic manager of the Canadian Marconi Co., Ltd., Montreal.

MR. W. H. DORMAN.—We regret to record the death of Mr. W. H. Dorman, founder of the firm of W. H. Dorman & Co., Ltd., engineers, Stafford. He was 93 years of age. After practising for some time as a consulting engineer in London, he spent some years in Sweden. He commenced business in Stafford half a century ago in partnership with Mr. W. Walker. Later the business was converted into a limited company.

MR. E. B. TURNER.—We regret to record that Mr. E. B. Turner, principal of the firm of Turner Bros., 134, Upper Thames Street, London, E.C., has passed away.

MR. JOHN STEPHENS.—We regret to learn that Mr. John Stephens, director and founder of the firm of Stephens, Smith and Co., Ltd., electrical engineers, Millwall, passed away on February 2nd at 47, Grosvenor Road, Ilford, at the age of 81 years.

MR. J. D. BAILIE.—We regret to learn that Mr. J. D. Bailie, the honorary secretary of the North Midland Centre of the Institution of Electrical Engineers, passed away on January 6th. Colonel H. C. Fraser, 36, Park Place, Leeds, has been appointed secretary in his place.

New Companies Registered.

Essex Radio (Ilford), Ltd. (211,225).—Private company. Registered January 21st. Capital, £50 in £1 shares. Objects: To acquire the wireless and any allied business now carried on by H. C. Cooksey and C. N. Godwin at 123, Ley Street, Ilford, as the "Essex Radio." The first directors are:—H. C. Cooksey, 14, Glencoe Avenue, Seven Kings, Essex; C. N. Godwin, 14, Glencoe Avenue, Seven Kings, Essex. Qualification, 1 share. Secretary: H. C. Cooksey. Solicitor: J. Elborne, 1 and 3, Cranbrook Road, Ilford, Essex. Registered office: 123, Ley Street, Ilford, Essex.

Bower Electric (1926), Ltd. (211,303).—Private company. Registered January 25th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical engineers, manufacturers of, and dealers in electrical, wireless, scientific and other apparatus, &c. The subscribers (each with 1 share) are:—J. R. Hudson, 2 and 3, Philpot Lane, E.C.3, solicitor; A. W. I. Mock, 2 and 3, Philpot Lane, E.C.3, clerk. The subscribers are to appoint the first directors. Secretary: D. H. Pisano. Solicitors: Abbott & Hudson, 2 and 3, Philpot Lane, E.C.3. Registered office: 15, Grape Street, Shaftesbury Avenue, W.C.2.

L. Weekes (Luton), Ltd. (211,327).—Private company. Registered January 26th. Capital, £6,000 in £1 shares. Objects:—To acquire the business of electric fuse manufacturers, electric switch manufacturers and general engineers carried on as "L. Weekes, Ltd.," at Langley Street, Luton. The subscribers (each with one share) are:—T. H. Dryden, Craven House, Kingsway, W.C.2, engineer; C. F. Butler, 331, Lordship Lane, East Dulwich, S.E.22, clerk. The directors are:—T. H. Dryden (permanent governing director) and A. L. Weekes. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Neve, Beck, Son & Co., 21, Lime Street, E.C.

Thor Lamps and Supplies, Ltd. (211,409).—Private company. Registered January 29th. Capital, £4,000 in £1 shares. Objects:—To adopt an agreement with Haslam & Stretton, Ltd., and to carry on the business and assets comprised therein, including the registered mark of the Thor Electric Safety Lamp, and to carry on the business of manufacturers of and dealers in electric, oil and other lamps, miners' lamps, electric batteries, &c. The directors are:—L. J. Bielski ((chairman), Treleaven, Penarth, coal exporter; C. W. Jones, 56, Victoria Road, Penarth, gentleman; T. Stretton, "Silbrook," Heoldon, Whitchurch, Cardiff, engineer. Qualification, £250 shares. Remuneration, £50 each per annum (chairman, £75). Solicitor: J. H. Davis, Boston Buildings, James Street, Cardiff.

Gregson Manufacturing Co., Ltd. (211,322).—Private company. Registered January 26th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of gas, electrical and general engineers, gas, electrical and wireless instrument manufacturers, manufacturers in wood and metal furniture, novelties, patterns, packing, materials, illuminated and other signs, &c. The directors are:—A. B. Gregson, 291, Hagley Road, Edgbaston, Birmingham, electrical engineer and commercial traveller (managing and life director); W. E. S. Salt, "The Royd," Handsworth Wood, Birmingham, C.A. (chairman); H. A. Taylor, 4, Brunswick Road, Handsworth, Birmingham, works manager. Qualification, £100. Secretary: J. S. Rogers, 41, Temple Row, Birmingham. Registered office: 37-38, Sun Street West, Birmingham.

Official Returns of Electrical Companies.

Reed, Evans & Co., Ltd. (72,015).—Capital, £100,000 in £1 shares. Return dated December 31st, 1925. 92,292 shares taken up. £6,576 paid (being £1 per share on 657 and 4s. per share on 29,595 shares). £85,716 considered as paid ((being £1 per share on 62,640 and 16s. per share on 29,595 shares). Mortgages and charges, nil.

Pickvance, Ltd. (183,595).—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated January 4th, 1926. 1,002 ordinary and 600 preference shares taken up. £650 paid on 200 ordinary and 450 preference shares. £952 considered as paid on the remainder. Mortgages and charges, £1,650.

Stanley Cooper & Co., Ltd.—Mortgage on 4, Albert Road, Bournemouth, with plant, &c., dated January 16th, 1926, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

Brookhirst Switchgear, Ltd. (175,995).—Capital, £550,000 in £1 shares. Return dated December 29th, 1925. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Pressland Electric Supplies, Ltd.—F. W. Stephens, of Salisbury House, London Wall, E.C.2, was appointed receiver and manager on January 15th, 1926, under powers contained in debentures dated June 30th and July 2nd, 1924, and August 10th, 1925.

L. Jacobs (London), Ltd.—W. S. Warren, of 8 and 9, Martin Lane, Cannon Street, E.C.4, was appointed receiver and manager on January 14th, 1926, under powers contained in first mortgage debenture dated May 22nd, 1925.

Woodhall Wireless Manufacturing Co., Ltd.—F. W. Stephens, of Salisbury House, London Wall, E.C.3, was appointed receiver and manager on January 18th, 1926, under powers contained in debentures dated April 28th, 1925.

British Automatic Telephone Installation Co., Ltd. (176,608).—Capital, £10,000 in £1 shares. Return dated December 22nd, 1925. 4,500 shares taken up. £4,418 15s. paid (being £1 per share on 4,175 and 15s. per share on 325 shares). Mortgages and charges, nil.

W. S. Laycock, Ltd. (in liquidation).—Satisfaction in full on June 20th, 1919, of charge dated April 4th, 1918, securing all moneys due or to become due from the company to the London Provincial and South-Western Bank, Ltd. (Notice filed January 20th, 1926.)

Sherlock Engineering Co., Ltd.—W. Hand, of Corfield and Cripwell, 12, Cherry Street, Birmingham, ceased to act as receiver or manager on January 15th, 1926.

Re-Echo Radio Co., Ltd.—C. H. Whatley, of 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C.2, was appointed receiver on January 25th, under powers contained in debenture dated January 4th, 1926.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £6,800 on December 17th, 1925, of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1925, securing £250,000.

D. Halett & Co., Ltd. (169,979).—Capital, £5,000 in £1 shares. Return dated December 10th, 1925. 4,420 shares taken up. £320 paid. £4,100 considered as paid. Mortgages and charges, nil.

Davies, Kent & Stewart, Ltd. (81,627).—Capital, £3,500 in 2,500 preference and 1,000 ordinary shares of £1 each. Return dated December 28th, 1925. 1,974 preference and 1,000 ordinary shares taken up. £2,974 considered as paid. Mortgages and charges, £1,050.

W. G. Cannon & Sons, Ltd. (87,796).—Capital, £3,000 in £1 shares. Return dated December 10th, 1925. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Venezuela Telephone & Electrical Appliances Co., Ltd. (31,305).—Capital, £280,000 in 140,000 ordinary and 140,000 preference shares of £1 each. Return dated December 29th, 1925. 70,000 ordinary and 70,000 preference shares taken up. £83,494 paid on 13,494 ordinary and 70,000 preference shares. £56,506 considered as paid on 56,506 ordinary shares. Mortgages and charges, £140,300.

Burwood (Concessionaires), Ltd.—Debenture dated January 15th, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. H. Wood, 20, Lesbia Road, Clapton.

G. S. Hawker, Ltd.—Mortgage dated December 31st, 1925, to secure £900, charged on 1 and 2, Purley Downs Road, Croydon. Holder: Mrs. E. Brockley, 110, Church Street, Croydon.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Siemens Bros. and Co., Ltd.

"The future of the electrical industry is encouraging, and it is believed that the company will obtain its full share of the work in the future." These words appear in the course of a circular issued by the secretary in which is announced the board's proposal to take steps to meet future capital requirements "in view of the expansion of the company's business and having regard to the Government's policy of electrical development as recently outlined by the Prime Minister." An extraordinary general meeting is called for to-day (Central Hall, Westminster) to pass the necessary resolution. Shareholders have already authorised an issue of 1,000,000 10 per cent. cumulative preference shares of £1 each, but of these only 550,000 shares have been issued and are fully paid, leaving 450,000 of such shares unissued. The board recommends that no further issue of these preference shares should be made and that the 450,000 unissued preference shares should be converted into ordinary shares. In addition, it is proposed that the total share capital, which is now £2,500,000, should be increased to £3,000,000 by the creation of a further 500,000 ordinary shares.

The recommended resolution reads:—

"That the 10 per cent. cumulative preference shares of £1 each be limited to the 550,000 of such shares now issued and fully paid, and that the 450,000 10 per cent. cumulative preference shares of £1 each now remaining unissued shall be and become part of the ordinary share capital, and that the share capital of the company be increased to £3,000,000 by the creation of 500,000 ordinary shares of £1 each, so that thereafter the capital of the company will be £3,000,000 divided into 550,000 10 per cent. cumulative preference shares of £1 each, all of which have been issued and are fully paid, and 2,450,000 ordinary shares of £1 each, of which 1,500,000 ordinary shares have been issued and are fully paid, and the remaining 950,000 ordinary shares are unissued."

German Companies.

The *Telephone Works Company* (formerly Berliner), of Hanover and Berlin, reports a net profit of 265,000 marks for 1924-25, which is to be carried forward.

The directors of the *Allgemeine Elektricitäts Gesellschaft* state that the turnover in 1924-25 was 50 per cent. greater than in the previous year. After writing off 3,058,000 marks for depreciation, as against 2,426,000 marks in 1923-24, the net profits for the year ended September 30th last amount to 8,363,000 marks (7,223,000 marks in 1923-24), and a dividend at the rate of 6 per cent. is proposed on the ordinary shares, this comparing with 5 per cent. in the previous year.

Fife Tramway, Light and Power Co.

The report for the year ended December 31st, 1925, states that the trading profits of the concerns owned and operated by the company amounted to £114,098. Of this, £21,089 was retained by the subsidiaries and the balance paid over. After meeting administrative expenses, taxation, &c., and adding £3,480 brought forward, there remains a balance of £85,542. Loan and debenture interest absorbs £13,973; the preference dividend requires £23,801; £4,268 is transferred to stock redemption account; and £10,000 to reserve account; a dividend of 6 per cent. for the year on the ordinary shares is recommended; and there remains a balance of £9,694 to be carried forward. The report says that the company's revenue has been adversely affected by the abnormal trade depression in its area, but this has been countered by continued extension. The meeting is to be held at Edinburgh to-day (Friday).

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted :—

Shanghai Electric Construction Co., Ltd.—100,000 shares of £1 each, fully paid, Nos. 400,001 to 500,000.

Traction and Power Securities Co., Ltd.—£65,036 4½ per cent. debenture stock.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Adelaide Electric Supply Co., Ltd.—£250,000 new 5½ per cent. redeemable consolidated debenture stock.

Traction and Power Securities Co., Ltd.—£65,036 4½ per cent. debenture stock.

Joseph Lucas, Ltd.—A meeting was to be held yesterday (Thursday) for the purpose of considering a resolution to increase the company's authorised capital from £800,000 to £1,100,000 by the creation of 300,000 shares of £1 each. It was explained in a circular that the new capital was required to finance the recent acquisition of controlling interests in C. A. Vandervell & Co., Ltd., and Rotax (Motor Accessories), Ltd.

Adelaide Electric Supply Co., Ltd.—The company has recently issued and sold at the rate of £96½ per cent. to the Electric and General Investment Co., Ltd., £250,000 5½ per cent. redeemable consolidated debenture stock. The stock is redeemable at par in the event of the purchase of the company's undertaking or at any time at the company's option after March 1st, 1939, on six months' notice.

Havana Electric Railway, Light and Power Co.—The *Electrical World* reports that the control of this company has been acquired by the Electric Bond and Share Co. The company operates the city railway and supplies electricity from a 50,000-kVA undertaking. The gross earnings exceed $15,000,000 per year.

Westminster Electric Supply Corporation, Ltd.—A final dividend of 2s. per share is recommended, making 15 per cent. for the past year. The directors have also instituted reduced charges, particulars of which are given in our "Lighting and Power Notes." The previous year's dividend was also 15 per cent., including a 3 per cent. bonus.

Metropolitan Railway Co.—A final dividend of 3 per cent. actual has been declared on the ordinary stock, making 5 per cent. for the year, as in 1924. The final dividend on the Surplus Lands stock is 2 per cent., actual, making 3¼ per cent. for the year, as against 3¾ per cent. in 1924.

Westinghouse Brake and Saxby Signal Co., Ltd.—The report for the year ended September 30th shows a net profit of £90,612, as compared with £17,192 in 1923-24. The dividend of 6 per cent. compares with 1½ per cent. in the preceding year. £17,503 is put to reserve and £7,866 is carried forward.

Company Struck Off the Register.—The name of the undermentioned company has been struck off the register, and it is thereby dissolved :—

Witchell's Electrical Accessories, Ltd.

City of Buenos Aires Tramways (1904), Ltd.—A final dividend of 1s. 3d. per share is recommended, making 5 per cent. for the year. It is also proposed to transfer £5,604 to the general amortisation fund and to carry forward £13,234.

Bournemouth and Poole Electricity Supply Co., Ltd.—The final dividends have been declared on the 4½ per cent. and 6 per cent. preference shares for the year ended December 31st last.

Smithfield Markets Electric Supply Co., Ltd.—A final dividend of 5 per cent. has been declared, making 8 per cent. for the year, as in the preceding year.

Enfield Cable Works, Ltd.—An interim dividend of 5 per cent. has been declared on the ordinary shares.

Dorman, Long & Co., Ltd.—An issue of £500,000 of 5½ per cent. first debenture stock, at 93½ per cent., was to be made this week.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have been cheered by a slight recovery in the price of raw rubber, which found reflection in the values quoted by the share market. From being plunged into despondency and depression, the rubber market turned cheerful again upon the very moderate rally in the price of the produce. This had an indirect effect in most departments of the Stock Exchange. The gilt-edged markets are firm, although there remains a lurking doubt as to the possible movements during February in the money market. In the electrical world, the boomlet in cable and equipment shares received something of a check, prices remaining good on the whole.

The hint as to probable forthcoming new issues, thrown out in last week's ELECTRICAL REVIEW (page 188), happened to appear on the same date as the announcement from Siemens Brothers that the company intends to take steps to meet further capital requirements. The board recommends that 450,000 unissued 10 per cent. preference shares shall be converted into ordinary and that the total share capital shall be increased from the 2½ millions sterling to three million pounds by the creation of a further half-million ordinary shares. The meeting to carry the necessary resolutions will be held on Friday in this week. Siemens fell back from 35s. to 33s. 9d. on the proposals.

The Metropolitan Railway fulfilled general expectation by announcing a dividend at the rate of 6 per cent. for the past half-year, making 5 per cent. for the year. This is satisfactory to the shareholders, who felt qualms about the maintenance of the dividend in view of the falling off of £246,000 in the gross revenue. The shrinkage is due to the fact that last year's Wembley Exhibition proved so much less popular than its predecessor. The price of the stock has risen 10s. and Surplus Lands are 2 up, at 71. Districts are better at 48. There has been a general rise in the issues of the Underground Electric Railways of London, the Income Bonds improving to a point below par.

The electricity supply market continues to be a little uncertain in regard to the issue of the Government's plans as this is likely to affect the older undertakings. In the new session of Parliament which has just opened, the Government's plans will no doubt be unfolded in sufficiently full detail to enable a better judgment to be reached than has been possible up to the present. We have already sketched some of the arguments that prevail in regard to the likelihood of the new plans interfering in no way with the existing London supply companies, and have suggested that, conceivably, the latter may be benefited rather than disadvantaged by the proposed legislation. It is natural enough, however, that proprietors of electricity supply shares, who can now see in most cases quite substantial increases in capital value over the original cost of their investments, should feel inclined to sell part for prudence sake. The idea has got abroad also that dividends on electricity shares are going to be limited to 7 per cent., an idea which conveys, of course, a totally wrong impression, because the companies are to distribute their reserves, and this distribution will, in the majority of cases, have the effect of bringing up the dividends to, roughly speaking, the rates that have been paid of late.

Charing Cross ordinary are down a shilling, Metropolitans are similarly lower and Kensingtons, after their burst of strength last week, have reacted to the extent of 5s. City of Londons are 2s. 6d. down, Westminsters a florin, and the only improvement in the London list is a gain of 1s. 3d. in South Metropolitan preference, which has lifted the price to 1 5/16. Whitehall Electric preference are better at £1. The provincial shares are unchanged in price on the week.

The outstanding feature in our share list this week is a rise of 6 in Brazilian Tractions, the price having risen to 92. No fresh reasons are advanced to account for this rise other than those already mentioned on several previous occasions in this column, namely, the buying from Canada and New York on the recently-increased dividend, and the report that the shares are being accumulated on behalf of a Canadian-American syndicate bent upon securing control. The 6 per cent. preferred have strengthened to 101. Beyond this, and a point rise in British Columbia deferred, the prices in the traction and tramway list show no changes.

A general drop in prices of shares in the manufacturing group is a sequel to the rather overdone character of the previous boomlet. British Electric Transformer preference are better at 1. Telegraph Constructions rose 10s. to 28. These are about the only upward movements. The falls are fairly extensive. General Electrics escaped from the reaction that included British Aluminium, British Insulated, India Rubber, Henleys, Johnson & Phillips, and several others. Babcocks participated with a drop to 52s. 6d. The reason that prompted the selling is that holders of such shares recognise the high levels which many of the quotations have reached, in relationship to the dividends that are being paid. That the companies are doing extremely well is generally known, but the recent advance in share-values has gone some way towards discounting the immediate future. It should be mentioned, however, that the market is by no means flooded with orders to sell. What the Stock Exchange calls—without being able to define—the undercurrent, is sufficiently strong to warrant the expectation of a further rise when the present sellers are "out."

Marconis are a dull market. Nor does the probability of a settlement being reached in the wireless strike serve to arouse interest in Marconi shares. The price has receded to 25s. Oriental Telephones are harder at 2 3/16. Automatics remain at 53s. 9d. The Eastern group of cable stocks and shares is placed. Rubber shares show a general recovery, but hesitation is felt as to the outlook for the raw produce market, and the public are playing for safety rather than for profits-by-purchase.

Share List of Electrical Companies.

	Nom. £	Dividend. 1923	Dividend. 1924.	Price Feb. 1, 1926.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	13	14	63/3	—	4 8 7
Brompton Ordinary	1	10	10	1½	—	*5 14 3
Charing Cross Ordinary	1	14½	15	47/-	−1/0	6 7 8
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	½	12	12	2 7/16	—	5 9 9
City of London	1	15	15	47/-	−⅛	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/6	—	5 4 11
County of London	1	15	15	58/3	—	5 3 1
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/-xd	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14¼	−¼	5 5 3
Lancs. Light and Power	1	7½	7½	26/6	—	5 13 2
London Electric	1	10	10	32/-	−1/-	6 5 0
do. do. 6% Pref.	5	6	6	5 7/8	—	5 7 10
Metropolitan	1	10	11	39/6	−1/-	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16¼	—	5 8 3
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	1 1/16	+ 1/16	5 6 8
Urban Ordinary	1	4	4	1	—	4 0 0
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	46/3	−2/-	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	+1d.	7 10 0
Yorkshire Elec.	1	8	8	31/-	—	5 3 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	69	—	5 16 0
Metropolitan	,,	4	5	69	+½	7 4 11
do. District	,,	3½	3½	48	+½	7 5 10
Underground Electric Ordinary	10	Nil	Nil	2¾	+¼	Nil
do. do. "A"	1/-	Nil	Nil	7/6	+6d.	Nil
do. do. Income	Bonds	6	6	99	—	*6 1 2
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	3	6	53/9	—	2 4 10
Chili Telephone	5	6	5	6⅝xd	—	*3 18 5
Cuba Sub. Ord.	10	5	5	6⅞	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	176½	—	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1¼	−1/16	8 0 0
Marconi Marine	1	10	7½	⅞	—	8 11 6
Oriental Telephone Ord.	1	12	12	42 7/8	+ 1/8	*5 9 9
United R. Plate Tel.	5	8	8	7½	—	5 2 7
Western Telegraph	10	10	10	18	—	*5 11 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅞	—	8 3 0
do. do. 2nd Pref.	5	6	6	3 1/16	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	105	—	5 14 3
Brazil Traction	100	4	4	92	+6	5 8 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	83½	—	5 19 9
do. do. Preferred	,,	96/-	96/-	102½	—	*4 12 8
do. do. Deferred	,,	129/5	129/5	128	+1	*5 1 8
do. do. Deb.	,,	4½	4½	77	—	5 10 5
London & Sub. Trac. 5% Pref.	1	2½	Nil	3/6	—	Nil
London United Tram. Deb.	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61¼	—	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	2⅝	−1/16	*4 11 5
British Aluminium Ord.	1	5	10	37/6	—d.	5 6 8
British Elec. Transformer Pref.	1	Nil	7	20/9	+9d.	6 14 11
British Insulated Ord.	1	15	15	3 1/16	−⅛	4 17 11
Brush Ord.	1	10	10	1 1/16	−1/9	6 19 2
Callenders	1	15	15	9½	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	34/6	—6d.	5 16 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	15	16	3 1/16	−⅛	4 6 10
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1 1/16	−1/16	*4 4 3
Johnson & Phillips	1	10	10	2 1/16	−1/16	3 8 3
Met.-Vickers, Ord.	1	8	8	29/3	—	5 9 6
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	33/9	−1/8	4 8 11
Telegraph Construction	12	20	10	28	+⅛	*4 5 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price February 2nd.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	—
a Ammoniac, Sal	per ton.	£60	—
a Ammonia, Muriate (large crystal)	,,	£52	—
a Bisulphide of Carbon	,,	...	—
a Borax	,,	£45	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	20/- inc.
a ,, Roll	,,	£9 10s.	20/- inc.
a Soda, Chlorate	per lb.	3½d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/8 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£250	£1 dec.
Grade II	,, ,,	£177	£1 dec.
Grade III	,, ,,	£98	£3 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn)	,,	1/- to 1/0½	...
c ,, Wire, basis	,,	10¼d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£65 10s.	...
d ,, ,, Sheets	,,	£144 10s.	...
d ,, ,, Wire Rods	,,	£75 10s.	...
d ,, ,, H.C. Wire	per lb.	9½d.	...
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/9	5d. dec.
l Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£12	...
g Lead, English pig	,,	£35 15s.	...
g Mercury	per bot.	£15 to £15 5s.	...
n Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
n ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/5½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire	,,	1/3¾	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/0½	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£277 10s. to £278 10s.	10/- inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
o C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

B.E.S.A. Publication.—The British Engineering Standards Association has just issued a specification for industrial reflector fittings for electric lighting (No. 1). It covers seven sizes of British industrial circular types, which are designated according to the nominal consumption of the lamps for which each is suitable, and the distribution of light contemplated is suitable for use in installations in which the spacing of the lamps is 1½ times the height.

A comprehensive table gives the nominal diameter, the minimum effective interior diameter, the minimum thickness of steel used for making the reflector fitting and particulars of suitable lamps complying with B.E.S.A. Specification No. 161, 1924, for each size of reflector fitting. The angle of cut-off specified complies with the recommendation contained in the second report of the Departmental Committee on Lighting in Factories and Workshops, 1921; but attention is drawn to the fact that this figure may be altered at a later date when the results of certain experiments which are being carried out are available. The total luminous output is given as 60 per cent., but it is pointed out that an efficiency of about 70 per cent. was obtained with this type of reflector under the conditions which were usual formerly: the conditions have been altered as mentioned above in order to reduce the amount of glare and so comply with the recommendations of the departmental committee. Methods of selection for testing and of efficiency measurement are also given in the specification.

Copies of the new publication (No. 232, 1926) may be obtained from the B.E.S.A. Publications Dept., 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page 193.*)

Everett, Edgcumbe & Co., Ltd.

This firm's exhibits covered a wide range, from a 2½-in. dwarf-pattern milliammeter up to a 300,000-V voltmeter, and from protective relays to integrating photometers. The latter each comprise a 3-ft. cubical enclosure, to which are attached the comparison and balancing arrangements necessary to enable the total flux of light in lumens to be determined at a single measurement. An outstanding feature of the exhibits was the Relay Graphic Recorder, fig. 20, designed for installation on electric trains, &c., where the conditions of vibration and acceleration are very severe. Three charts give simultaneous records of current, voltage, and train speed. They are driven over revolving drums in perfect synchronism by a small motor running at constant speed. The motor also provides the necessary power for moving each recording pen across

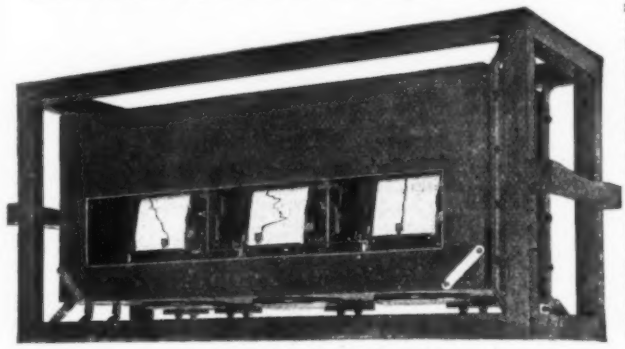


Fig. 20.—Relay Graphic Recorder.

the respective chart, in response to the deflection of an electrical movement, designed to measure the quantity in question. The correct timing of the charts is ensured by a sensitive centrifugal speed governor, which varies the field strength of the motor as may be necessary to make it run at constant speed, whether on a.c or d.c. The measuring element proper consists of a short arm, provided with a substantial contact, which moves between two fixed contacts, serving to energise one or the other of two electro-magnets, which, in their turn, operate a simple two-way friction clutch. This clutch causes the driving motor to carry the pen across the chart in one direction or the other, according to the dictates of the measuring unit. The whole action is claimed to be perfectly dead-beat and "snappy." It is also claimed that all friction between the inking mechanism and the paper is eliminated, so that, if desired, a delicate electrical movement may be employed. The absence of the clock with its attendant troubles is another advantage. The instrument is rendered immune from the ordinary disturbances of vibration by the provision of a special spring suspension in a cradle. Any number of recording mechanisms can be operated simultaneously from the single driving motor, with the certainty that the charts are running in perfect synchronism. There are also a number of attachments for indicating different conditions. It is understood that a number of these instruments have been supplied to railway authorities, both in this country and abroad, and are giving every satisfaction.

Fig. 21.—Large-Scale Cell Tester.

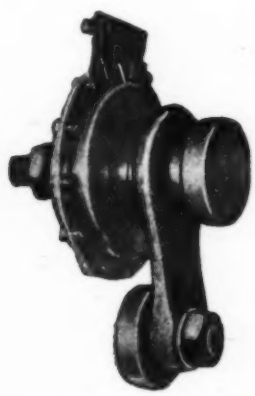


Fig. 22.—Radio-Frequency Current Transformer.

Another interesting exhibit took the form of a new cell-testing voltmeter, fig. 21. The feature of this instrument is the "super-scale," rendering the indications particularly easy to read. It is suited for testing high-pressure batteries, the case and handle being made of insulating material, moulded in one piece.

A 1,000-A current transformer, fig. 22, designed for radio frequency measurements, was another item of interest on this stand. This device, which is of the patented construction due to Mr. F. Ockenden, is believed to provide the only satisfactory solution of the problem of designing a current transformer which will stand up to frequencies of 100,000 cycles or more, and which, at the same time, is thoroughly shielded from stray radio-frequency fields. The design is based upon the fact that for satisfactory operation, the magnetic linkage between the primary and secondary circuits must be perfect, and this result is obtained by completely surrounding the iron core and its secondary winding by the primary winding, which consists of a complete copper sheath. We understand that these transformers have been supplied for frequencies up to 5,000,000 cycles (corresponding to a wave-length of about 60 metres) and, in fact, have been adopted exclusively for the new Post Office transmitting station at Rugby.

A high-pressure electrostatic voltmeter, claimed to be the smallest of its kind yet produced, was also seen. It can be scaled up to 3,000 V for a.c. or d.c., and measures only 2½ in. across the dial. It is designed to meet the requirements of radio engineers, especially for use on aircraft, where both space and weight are of fundamental importance, but where, at the same time, the working conditions are most severe. The whole of the high-pressure movement is mounted on a solid base of insulating material, a cavity in which serves as the damping chamber.

Siemens Bros. & Co., Ltd.

This firm showed some new water-tight indicator and selector switch combinations for use with thermo-electric pyrometers and distance thermometers, which are designed particularly for use on board ship but are suitable for use in any place where protection from damp and moisture is necessary. The indicators are of the pivoted moving-coil type and are of robust construction. The scales are calibrated in Centigrade or Fahrenheit degrees, as desired, and the movements, &c., are enclosed in strong water-tight gunmetal cases. The selector switches are of the press-button type, the buttons being

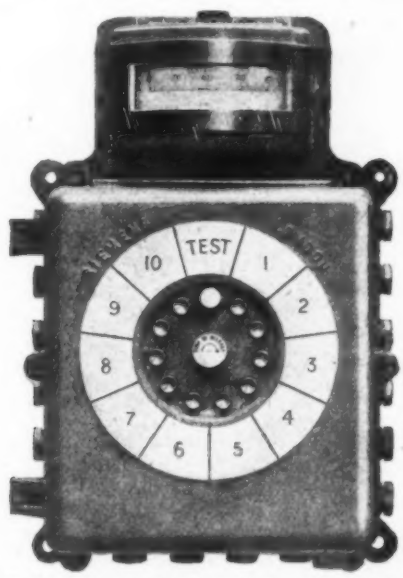


Fig. 23.—Pyrometer Switch and Indicator Combination.

arranged in a circle. Any thermometer may be instantly connected to the indicator by pressing the corresponding button and will remain connected until a second button is depressed, when the first one is automatically released. The last-pressed button may also be released by turning a central knob. Either packed glands or conduit nipples are provided for the cable inlets. Fig. 23 shows a 10-way selector switch and indicator combination. A four-colour temperature recorder, an optical

pyrometer for measuring temperatures up to 2,400 deg. C. and a thermo-electric potentiometer for the measurement of thermo-couple e.m.f.'s were among the other exhibits of this firm.

The Zenith Manufacturing Co.

Among the items of interest exhibited by this firm was a neon-tube rectifier, fig. 24, designed for charging small high-pressure accumulators of the kind now in fairly common use for radio reception, being suitable for a charging current of 0.19 A. It is equipped with a regulating resistance in the primary circuit so as to give a very wide control of the charging pressure and current, rendering it capable, it is claimed, of covering all ordinary conditions. The resistance, together with a d.p. fuse and switch, is fitted at the side of the containing cabinet in a readily accessible position.

Fig. 24.—Neon Tube Rectifier.

The rectification is effected by means of two large neon rectifier tubes fitted in the cabinet in a vertical position. Owing to the large electrodes necessary in these tubes it is essential that the latter are operated vertically, otherwise the weight of the electrodes would be likely to fracture the glass support in the event of the rectifier receiving a sharp knock or serious vibration. The overall efficiency of the device is claimed to be of the order of 30 to 38 per cent. The complete rectifier is furnished with flexible cords and lamp adaptor, and battery clips for connection to the accumulator and lamp socket during charging.

George Kent, Ltd.

The chief exhibits of interest by this firm were Avery- and Martin-type telerecorders for measuring steam or water flow. The Avery instrument is designed primarily for a.c. The transmitting instrument, fig. 25, consists of a variable transformer, the rotating portion of which is moved in proportion to the rate of flow through the main. A secondary voltage is induced in the rotating element, which varies from zero to its maximum value in accordance with the variations in the rate of flow. The energy supplied to the primary also passes through a current coil of an "inverted" watt meter,

Fig. 25.—Telerecorder A.C. Transmitter.

which serves as a counter instrument for registering the total quantity of steam or water passed, and the induced energy is passed through the pressure element. By means of a solenoid connected across the instrument terminals, an artificial pressure drop is used to compensate for fluctuations in the line voltage.

The Martin-type instrument is used in connection with d.c. The transmitter consists of the usual boiler-load indicator, and the movement is effected by means of a suitable cam on a contact arm, which moves across the surface of a resistance connected across the d.c. mains. The contact arm moves in accordance with the variation in the rate of flow, and causes the ratio between the two parts of the resistance to vary, the parts referred to being divided by the point of contact with the arm.

Weston Electrical Instrument Co., Ltd.

A new portable miniature a.c. voltmeter, model 330, was seen among the exhibits of this firm; but for a deeper base it resembles the d.c. model 280. The movement is of the iron coil dynamometer type suitable only for a.c. circuits. It has a resistance of 20 ohms per volt and is claimed to be accurate to about 1 per cent. A new radiator panel voltmeter, 2 in. in diameter, and designed for use upon receiving sets, was another interesting exhibit. For ranges below 50 volts it has a sensitivity of 125 ohms per volt and for higher ranges, 200 ohms per volt. Another new exhibit was the firm's model 440 portable pivoted moving-coil galvanometer. This instrument has a 1 mm. deflection. A.c. and d.c. dynamometer-type laboratory standard instruments were shown and also various patterns of switchboard instruments. A range of miniature instruments added to the interest of the display. Some of these are of particularly delicate construction, the movements weighing as little as 5 grains.

The Cox-Cavendish Electrical Co. (1924), Ltd.

On this stand was shown some actino-therapeutic apparatus for ultra-violet radiation and a diathermy apparatus for thermo-penetration or coagulation of the tissues.

Edison Swan Electric Co., Ltd.

This firm exhibited a range of d.c. Pointolite lamps, varying from 30 to 1,000 c.p., and a selection of 150 c.p. Pointolites for a.c. operation.

The New Oscilloscope Co., Ltd.

This firm showed the Elverson oscilloscope used for investigating the behaviour of machinery under working conditions.

Adam Hilger, Ltd.

Among several interesting items displayed on this stand was a piezo-electric resonator by which the piezo-electric effect in quartz crystals is applied to the control of radio transmitters and in the standardisation of wavemeters and kindred apparatus. When a series of potential variations is applied at varying frequencies there is a marked resonance at a frequency dependent upon the dimensions of the crystal, with a consequent alteration in the state of the associated electrical circuit. Hence by subjecting the crystal to the influence of an alternating electrical impulse supposed to be of its resonant frequency its accuracy may be verified and corrected when suitable means of indication are employed. The quartz is encased in a suitable insulating material and provided with two exterior terminals. Another exhibit was a selenium detector. This is a new apparatus designed for detecting infra-red, visible and ultra-violet radiations by noting the alterations produced in the electrical properties of selenium caused by radiations incident upon it. It was exhibited in conjunction with a Hilger ultra-violet monochromatic illuminator showing the ultra-violet spectrum of mercury vapour. The cell is of course connected to a sensitive galvanometer. The Hilger therapy spectroscope was also shown. This is a simple type of quartz train spectroscope provided with a fluorescent screen to make visible the ultra-violet portion of the spectrum under observation, designed for checking the ultra-violet emission from lamps used in ultra-violet treatment.

Newton & Wright, Ltd.

Some heavy apparatus was shown by this company; a notable feature of the exhibit was a 125,000-V unit of a three-phase transformer, to work in connection with a rectifier of new design, giving 10 milliamperes at 250,000 volts, for X-ray work, being one of a pair ordered for cancer research. The bushings were oil-filled, and the top cover was of horn fibre. The weight of these transformers is two tons each.

Amongst other items were the "Hercules" X-ray tube, and a new foot-operated switch. For the prevention of corona at the high pressures used in X-ray work, C.T.S. reel cables were shown.

Stonebridge Electrical Co., Ltd.

This company showed a wide range of instruments in a variety of styles and finishes, including flush edge-wise instruments with flat front plates, electrostatic voltmeters for ranges up to 150,000 volts, recorders, portable precision instruments covering a variety of purposes, and resistance thermometer equipments for generators and transformers.

Creed & Co., Ltd.

The Creed "Start-stop" printing telegraph system, said to be the first of its kind developed in this country, was shown, the instruments comprising a keyboard transmitter and perforator, an automatic transmitter, and a printer. The first-named may be used for direct transmission by hand from the keyboard, or in conjunction with the automatic transmitter. The printer is on the same lines as the well-known Creed standard printer. The Murray Multiplex system was also exhibited.

(To be concluded.)

The Power Factor of a Cable Dielectric.*

Its Consideration as a Function of the Applied Voltage.

By L. EMANUELI, M.I.E.E.

THE relation between the power factor and the dielectric of an impregnated-paper cable and the applied pressure is, to say the least, complicated. It has been pointed out, however, that it is a means of judging the quality of the cable and accordingly details of the study of the subject will be of interest.

The first experiment was carried out on a certain fixed quality of paper, impregnated with different qualities of oil and compound, under such conditions that bubbles, or films, of gas were eliminated. A second series of experiments was also carried out. For the first series the apparatus shown in fig. 1 was used. The paper was dried in a stove and placed in several layers between the two electrodes *a*, furnished with

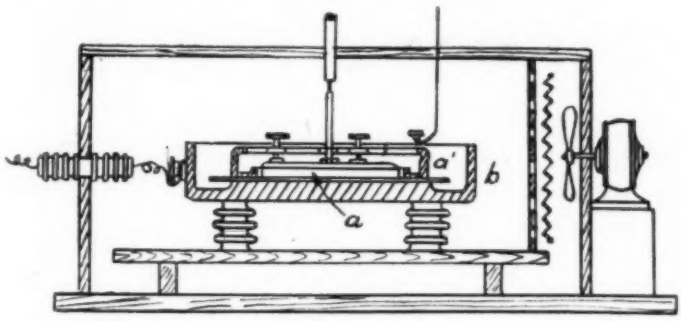


Fig. 1.

a guard ring *a'* and *b*, both suitably heated; keeping *a* raised a few centimetres above the surface of the paper sheets, a vaccum was created in the apparatus, the large opening at the top being closed with a suitable cover. The complete apparatus was placed in a stove so that, besides the vacuum, a temperature of nearly 90 deg. C. could be maintained.

After some hours in vacuum, the oil, or the compound, under examination (previously dried) was introduced into the apparatus by means of atmospheric pressure. The vacuum was maintained for at least three hours, then broken, and when the apparatus had cooled the top *a* was allowed to come into contact with the surface of the paper, this being done in order, so far as was possible, to prevent gas films forming in the dielectric. The measurements at different temperatures were generally made in steps of increasing temperature, in order to avoid the thermal contraction of volume giving rise to gas films. This precaution was subsequently found to be unnecessary.

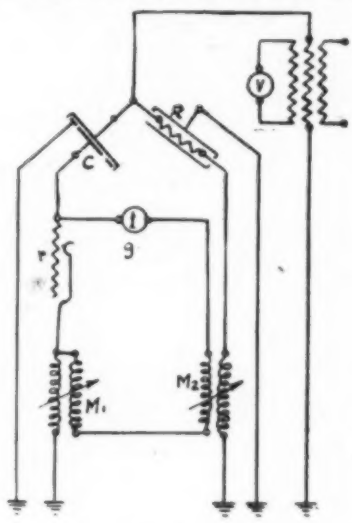


Fig. 2.

The method used to determine the power factor is shown by fig. 2, C being the condenser under test, R the ohmic resistance, M_1 and M_2 two mutual inductances (only one of which need be variable), *r* a resistance, and *g* a vibrating galvanometer. When the phase angle of the dielectric is small, then $C = M_2/rR$ and $\cot \phi \div \cos \phi = \omega M_2/r$. It has been supposed that R is great in comparison with the self-induction of the primary of M_1 and that the resistance of M_1 is small in comparison with the capacity of C. These conditions were satisfied in the tests, the value of C being of the order of 0.0006 microfarad (the frequency was 42); the ohmic resistance of the primary coil of M_1 was 17 ohms and the coefficient of self induction of the

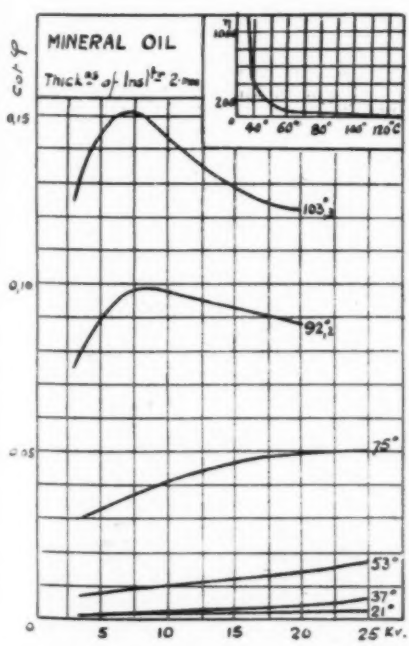


Fig. 3.

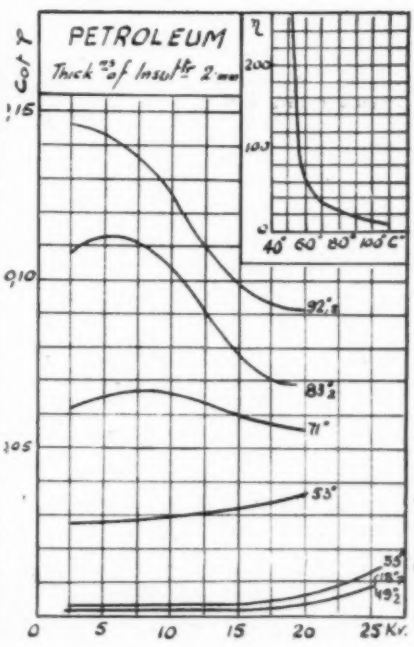


Fig. 4.

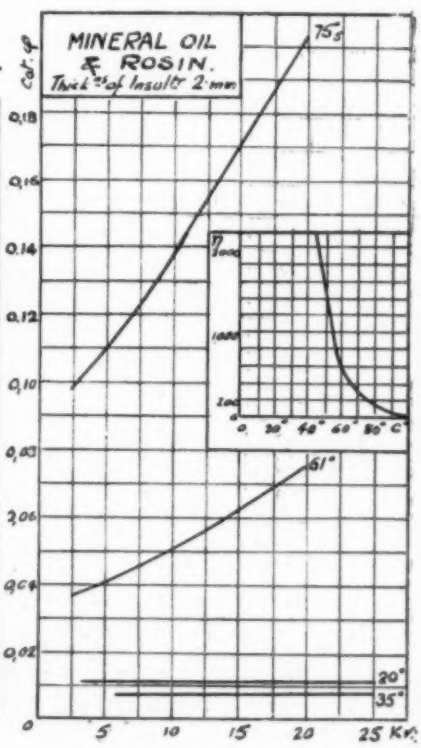


Fig. 5.

* A paper read before the third meeting of the International E.H.P. Conference, Paris, June, 1925, and reproduced by permission of the Conference.

primary coil of M_2 was 118 millihenrys. Owing to the fact that R is not a pure resistance and to the presence of the inductance of the primary coil of M_2 the phase error was measured once, using an air condenser instead of C, as well as comparing R with a water column resistance and calculating the effect of the inductance in series. Thus, a value was found

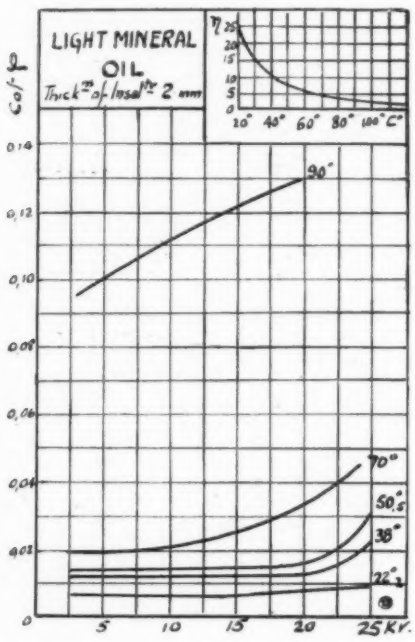


Fig. 6.

that made it possible to correct the result obtained for cot ϕ of the condenser under test.

Fig. 3 shows the functioning of cot ϕ of a condenser formed of paper impregnated with dense mineral oil of a type used for the cylinders of a steam engine, which is generally used for cable impregnation either alone or mixed with rosin. At low temperatures cot ϕ is practically constant, despite variations in the applied pressure normally used in cables. For

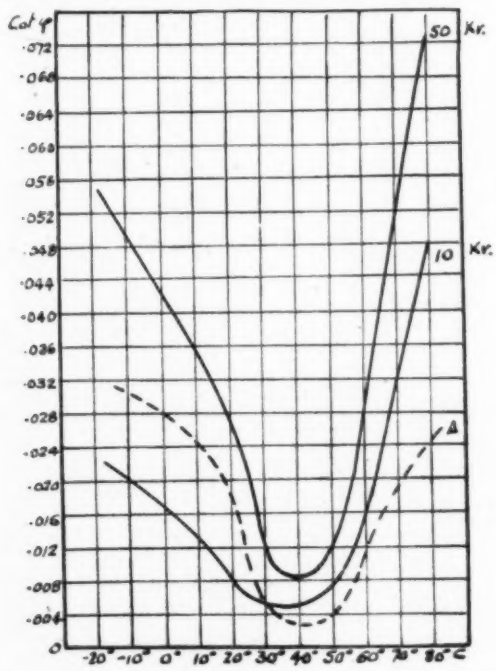


Fig. 7.

higher values of temperature, cot ϕ increases with an increase in pressure. The value of the voltage at which the constancy of cot ϕ ceases seems to decrease with the increase of temperature until at high temperatures the curve of cot ϕ shows a maximum value, and this seems to take place at a voltage which becomes lower as the temperature is increased.

Fig. 4 refers to a petroleum type oil, and fig. 5 to the oil of fig. 3 mixed with 35 per cent. of rosin. Fig. 6 refers to a very fluid oil, used for transformers.

It is difficult to arrive at a definite conclusion from the above experiments, but it is quite probable that in the range of temperature between 12 deg. and 30 deg. C. and with the gradients used in cables, the variation of cot ϕ with the voltage is very small, so that it may be considered practically constant.

In cables the matter is very different, especially because of the gas films left during the impregnation, the dimensions of which change with the temperature and with the history of the conditions which the cable has been subjected to. The amount of data obtained is voluminous; the following are some characteristic results: Fig. 7 refers to a three-phase cable of 35,000 volts working pressure, with conductors of 175 mm², and it shows the change in the relation of cot ϕ with the temperature, measured at 10,000 and 50,000 volts. In the figure there is also shown (dotted line) the curve of the difference in power factor at the two voltages; the latter curve is characteristic, and all cables show it in greater or less proportions.

The presence of a minimum may be explained by the aid of the first series of experiments in the following way: Starting from low temperatures, it may be assumed that the volume of the gas films decreases with an increase of the temperature, due to the fact that the impregnating mixture increases in volume. The pressure of the gas in those films need not necessarily increase very much, because with the increase of temperature and pressure, the gas is more soluble in the compound. Therefore, the variation of cot ϕ with the voltage decreases with the increase of temperature; on the other hand, at a certain temperature, which varies with the type of com-

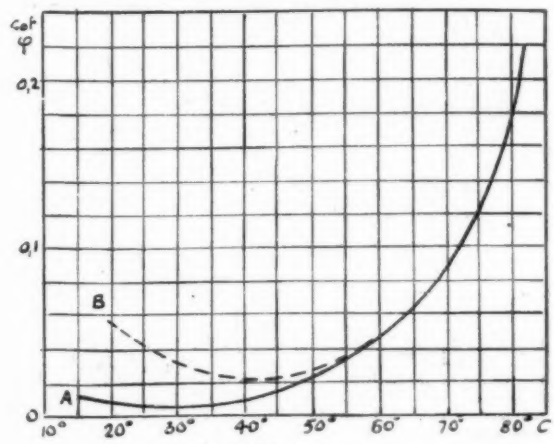


Fig. 8.

pound, cot ϕ ceases to be constant and increases with the voltage. The sum of the two phenomena leads then to a minimum value.

With the aid of the following experiments it may be demonstrated that the first portion of the curve is a fraction of the degree of impregnation of the cable, whilst the second is, practically, only a function of the impregnating material. A single conductor cable was heated at a temperature of 85 deg. C. for some hours in order to ensure that the empty spaces should be increased, either on account of some compound escaping from the ends of the cable, or the fact that the lead sheathing was increased in diameter under the pressure of the compound itself. The curves of cot ϕ at 10,000 and 50,000 volts were determined before and after heating, and the difference between the two values is shown in fig. 8. It can be easily seen that the portion of the curve that corresponds to the high temperature is practically not changed, whilst at low temperatures the difference between the values of cot ϕ at high and low pressures is considerably increased.

From what has been shown above, it follows that under certain limitations of temperature the variation of the power factor may be an index of the degree of impregnation of the cable. It is questionable, however, if it would be right to impose strict conditions on the manufacturers when the heating of the cable under working conditions may spoil the impregnation of the dielectric in a permanent and irreparable way. From this point of view the question arises whether, for high-pressure cables, a limit to the working temperature can be determined, considering the possibility of spoiling the impregnation and taking into account also the periods of low temperature at which the cable may be required to work. It must be observed, however, that although it may be easy to make qualitative statements on this subject, it is not such an easy matter to arrive at exact limiting figures.

R.A.F. Vacancies.—The Air Ministry announces that five hundred aircraft apprentices, between 15 and 16½ years, are required by the Royal Air Force for entry into the School of Technical Training, Halton, Bucks. They will be enlisted by open and limited competitions held by the Civil Service Commissioners and the Air Ministry respectively. Successful candidates will be required to complete 12 years' service from the age of 18, in addition to the training period. Full information regarding the scheme can be obtained from the Royal Air Force (Apprentice Department), 4, Henrietta Street, W.C.2.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric Hammer.

A recent development in the United States takes the form of a new electric hammer working on the principle of the electro-magnetic coil and its attraction for an iron core. The Syntron hammer, fig. 1, operates on ordinary 60-cycle electric circuits with 3,600 blows per min. on the shank of any tool inserted into the bit. In contrast to the usual motor-driven hammer, it has only one moving part, the piston, which is drawn back and hurled forward through a bronze barrel. The hammer is suitable, it is claimed, for drilling holes in concrete, brick or stone, for smoothing stone or concrete surfaces, for bush hammering, cutting, channeling, &c. When used with a star drill, the hammer is rated to drill concrete to a depth of three in. per min. The device is manufactured by the NATIONAL ELECTRIC MANUFACTURING COMPANY, of Pittsburgh, Pa., U.S.A., and is distributed in all countries outside the United States by the Westinghouse Electric International Company.

Fig. 1.—Electro Magnetic Hammer.

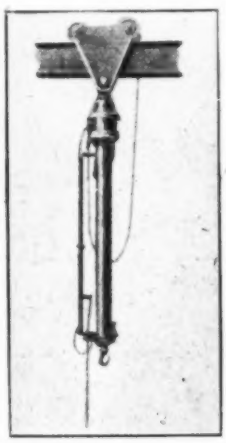


Fig. 2.—Electric Oil Hoist.

An Electric Oil Hoist.

An electric oil hoist, fig. 2, which has been marketed by the AMERICAN HOIST & DERRICK CO., St. Paul, Minn., is described in the *American Machinist*. It consists of a cylinder and piston with a load hook attached to the latter. An electric motor and an oil pump are provided at the top end of the cylinder and a system of piping and operating valves is placed between the pump and the cylinder ends. The motor, which is controlled by a snap-switch, pumps the oil from above to below the piston, thus raising the load. A valve in the piping is regulated to allow the piston to force the oil back again to the top of the cylinder, the piston and load descending under gravity. By regulating the valves the load can be raised or lowered to any point within the travel limits of the piston. A truck arrangement for suspending the equipment from an overhead track is provided.

An Improved Coal-cutter Protection.

In view of the recent Home Office recommendations to the effect that the coal-cutter machine must have a flame-proof enclosure separate from the starter enclosure, the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, has produced a new system for the automatic protection of coal cutters, coal conveyors, and trailing cables. The essential apparatus for the new system includes a low-voltage control switch, supplied for mounting in any type of coal cutter, a special gate-end starting box, and a standard form of trailing cable with suitable standard terminal plugs.

The motor cannot be started, it is claimed, except by a simple flameproof drum switch mounted on the coal cutter, and has only three positions, *viz.*, forward, off, and reserve. The pressure of the control circuit does not exceed 20 volts, the power circuit to the motor being made and broken in the gate-end starting box. Overload and no-volt relays are re-set from the coal cutter simply by bringing the starting handle to its off position. A sensitive leakage trip device acts instantaneously with leakage to earth or between phases, and is capable of being adjusted to trip down to 5 per cent. of the full-load current of the motor, and after a leakage trip the relay remains latched out, preventing a re-start. A mechanical interlock prevents the opening of the starter box except with the contactor in the open position, and the motor cannot be started from the coal cutter until the gate starting box is properly closed. The box is fitted with an external lever by which the coal-cutter motor can be stopped under all conditions. Red and white signal lamps mounted in a flame-proof device within the gate-end box behind stout glass windows, show respectively when the gate-end box is connected to the supply, and when current is through to the coal cutter. Standard trailing cables and terminal plugs and sockets are used. Rise above earth potential of the casing of either the coal cutter or gate switch is guarded against by making it impossible for the motor either to start or to run except with an efficient earth connection between the case of the control switch on the coal cutter and the case of the gate-end starter. The apparatus is mounted within a strong flameproof boiler-plate box. Both front and back covers slide within deep machined grooves, and have handles for easy withdrawal.

The principles of operation may be seen from the diagram, fig. 3. The main power circuit passes from

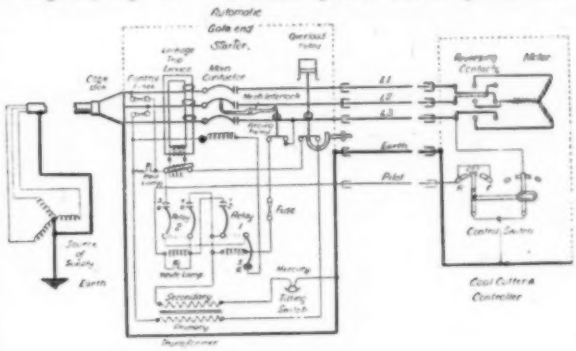


Fig. 3.—Diagram of Coal-Cutter Protection.

the incoming cable box on the gate-end starter, round the leakage trip device, to the main contactor, one lead passing round an arcing relay and an overload relay, and the three-power cores L1, L2, and L3, of the trailing cable leading *via* reversing contacts on the coal-cutter control switch to the motor. Control circuit No. 1 passes from incoming lines the L1 and L2 through control fuses shown adjacent to the cable box, through the contacts of the leakage trip device, the contacts of the overload relay, and the transformer primary. Control circuit No. 2 passes from the transformer secondary through the tilting switch to the starter-box case, through the earth core to the coal cutter case, the auxiliary contacts shown to the right in the diagram of the control switch to power cable L3, through the contacts of the arcing relay and a fuse to the operating coil of off position re-set relay No. 1, and back to the transformer secondary. Control circuit No. 3 passes from the transformer secondary, through contacts 1 and 2 of Relay 1, through the operating coil of Relay 2, through the pilot core to Contacts R or F of the controller, through the case of the coal cutter and the earth core to the case of the gate-end switch, and thence through the tilting switch back to the transformer secondary.

An Improved Hole Cutter.

Cooke's improved hole cutter, fig. 4, which is marketed by the SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2, should prove a very useful tool for electrical wiremen and fitters in many cases where it is required to drill large holes in metal posts, boxes, &c., in positions which do not lend themselves to the use of ordinary drillers, ratchets and clamps, &c. It consists of a small threaded centre pin, provided with a hollow head, to contain the cuttings and chips, which is inserted in a prepared pilot hole. A knurled feed nut is screwed down until the cutting edges engage with the surface of the plate and the body of the tool is revolved by means of tommy bars, pressure being gradually applied until the hole is completely made. It is claimed that burring or mis-shaping of the edge of the hole is prevented by the fact that the upstanding rim of the pressure pad holds the job in close contact with the cutter.

Fig. 4.—Improved Hole Cutter.

Metal-clad Switchgear for Single-phase Circuits.

New Ferguson, Pailin Single-pole Gear for Sub-circuits.

IT has been said that the use of metal-clad switchgear of the draw-out or drop-down patterns for controlling high-pressure, single-phase, sub-circuits, though often desirable, has been "prevented by the prohibitive cost of that type of gear." Accordingly, in order to meet the case, Messrs. Ferguson, Pailin, Ltd., are now manufacturing a "type AV" single-pole switch with a maximum capacity of 100 amperes at 3,300 volts, which is arranged for mounting on pipe framework, isolation being accomplished by lowering the movable portion. The fixed portion, fig. 1, comprises a casting that accommodates the busbar, neutral bar (if required), cable box, isolating contacts, and downrods for supporting the removable portion. A hinged plate covers the isolating contacts when the switch portion is withdrawn, thus rendering all live gear inaccessible, while the busbar is of circular section and between units is run in iron tube; both the busbar chamber and cable box are compound filled. The cable-box is suitable for either single-core or concentric cable and provision is made for accommodating a neutral link if it is desired to isolate the neutral connection.

The removable portion of the switch, fig. 2, comprises the circuit breaker, trip coil, and isolating contacts. In order to isolate the breaker it is only necessary to undo the nuts at the bottom of the down-rods and the whole of the circuit-breaker portion as shown in fig. 2, and trip coil, which are mounted on a frame arranged to fit inside the oil tank, may be removed. The breaker contacts are of the standard Ferguson, Pailin laminated-brush pattern with arcing tips; the operating mechanism has a parallel motion and a free-handle, while overload protection may be obtained by means of a directly-connected overload coil, and an adjustable oil dashpot time lag may be fitted if desired. The complete unit has been designed to occupy the minimum space and may be mounted at 8-inch centres.

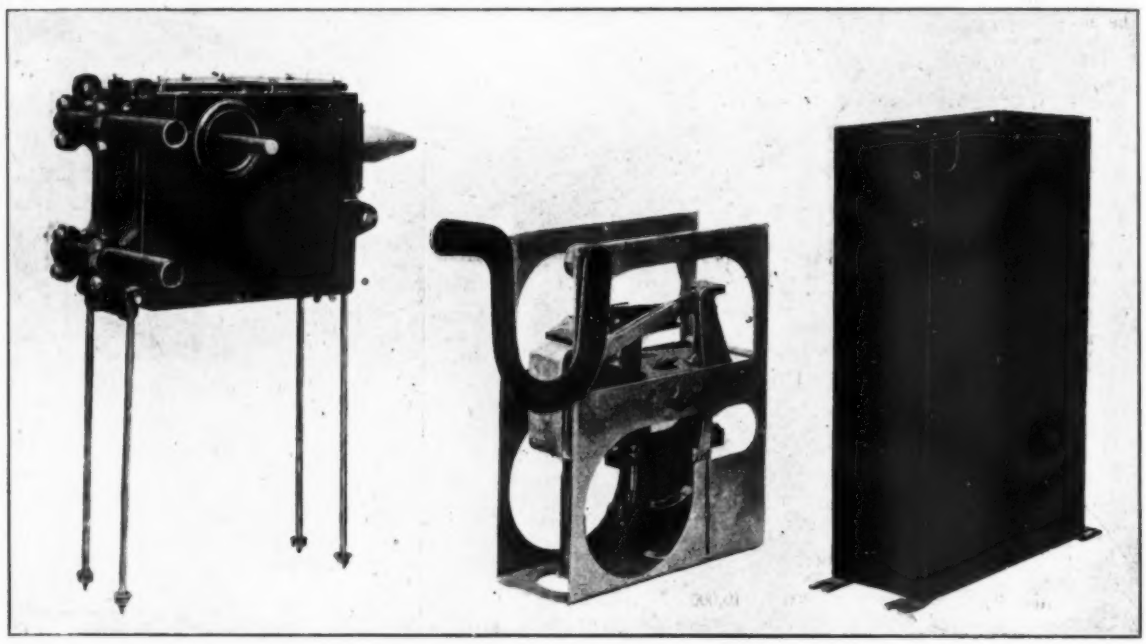


Fig. 1.—Fixed Portion. Fig. 2.—Circuit Breaker. Fig. 3.—Oil Tank.

New Ferguson, Pailin Metal-Clad, Single-Pole, Switchgear for Small Single-Phase Circuits.

British Electrical Plant for Costa Rica.—A preliminary agreement has been entered into between a British electrical company and the Compañia Nacional Hidroeléctrica de Costa Rica for the installation in the capital, San José, of a new hydro-electric plant. The whole of the equipment will be of British manufacture.—*Reuter's Trade Service* (San José).

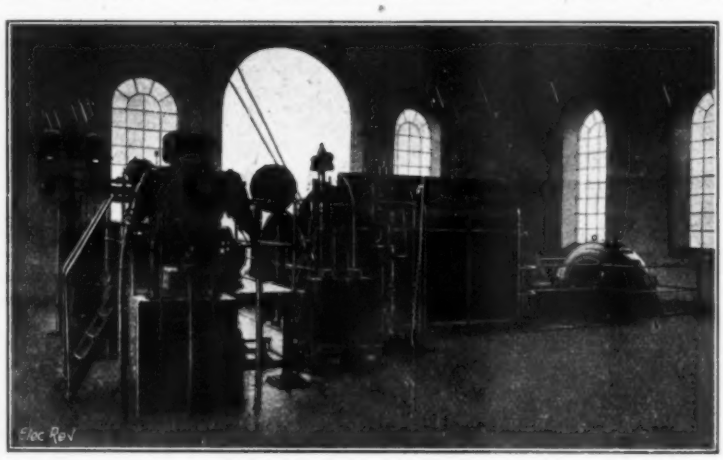
A Modern Electric Winder.

Some Particulars of the Plant at North Celynen Colliery.

AN interesting example of an electrically-operated winding plant is to be found at the new house-coal pit of the Newport Abercarn Black Vein Steam Coal Co., Ltd. It is designed for an output of 270 tons per hour from a depth of 510 ft. and has a cylindro-conical drum 8 ft. to 12 ft. in diameter, single-reduction straight-tooth gearing being employed between the electric motor and the drum.

Although it was first used for sinking the pit, it is now employed for lifting coal; the drum diameters are proportioned to give lower power peaks throughout the wind.

Straight-post brakes are fitted with cast-steel bracket ends; they are housed in heavy cast-iron brackets and carry wooden blocks. The brake force is applied through a spring in conjunction with a floating lever, and while the braking effort is ordinarily derived from weights, assistance is given by introducing air to the top side of the brake piston, the combined effort being sufficient to hold the maximum pull of the motor. The brake solenoid is capable of giving a pull of 100 lb. through a 2-in. stroke. It is designed for a service of 40 operations per hour, and is supplied at 400 V from a 5-kVA transformer. It operates two single-pole, ironclad, limit, self-resetting switches. The overwind and overspeed preventer is of the "Whitmore" type. A dial-type depth indicator is installed on the machine, the pointer of which makes about ½ of a revolution during the wind. The control platform carries all the operating gear, including the motor control lever, the brake



The North Celynen Electric Winder.

and emergency levers, and a gear for tripping in the case of current or air-pressure failure.

A 400-h.p. motor, 412 r.p.m., 2,200 V, 3-phase, 50 cycle, drives the winder. It is mounted on two pedestal bearings, and is fitted with a half-coupling forged solid with the motor shaft for connection to the gears. The switchgear consists of a draw-out circuit-breaker pedestal, controlling the main 2,200-V, 3-phase, 50-cycle supply; the pedestal carries the current and potential transformers for the ammeter and voltmeter installed on the instrument pillar, and trifurcating boxes for the incoming and outgoing mains.

The oil circuit breaker has three overload time-limit releases and a low-voltage no-close device. A suitable tank lifter is also provided for the breaker.

The motor is operated by a liquid-controller of the moving-electrode type, arranged for both hand and compressed-air lever operation, and is provided with accelerating governor gear. The electrodes are so arranged that they are continually submerged in the electrolyte, thereby preventing any possible chance of open flashing between the phases.

The installation was supplied by the General Electric Co., Ltd., in conjunction with its Fraser & Chalmers Engineering Works.

The Electrical Imports of Peru.

THE following figures show the values of the imports into Peru of electrical goods and apparatus in 1924. Comparative figures for 1923 are also given, together with a note of increases or decreases. The Peruvian £ = about 20s.

	£P 1923.	£P 1924.	Inc. or dec. £P
Electrical accessories, e.g., switches, cutouts, plugs, lampholders—			
Total	21,000	37,000	+ 16,000
From Germany	9,000	16,000	+ 7,000
„ Great Britain	500	2,000	+ 1,500
„ United States	11,000	9,000	− 2,000
Accumulators and batteries—			
Total	12,000	14,000	+ 2,000
From Germany	2,000	2,400	+ 400
„ United States	7,600	10,000	+ 2,400
Insulators and tubes—			
Total	8,000	20,000	+ 12,000
From Germany	2,000	5,000	+ 3,000
„ United States	5,500	9,400	+ 3,900
„ Great Britain	700	3,000	+ 2,300
Copper wire, covered, except with silk, up to 3 mm. in diam.—			
Total	13,500	13,700	+ 200
From Germany	3,000	3,300	+ 300
„ United States	7,500	5,300	− 2,200
„ Great Britain	2,000	1,500	− 500
Ditto more than 3 mm. in diam.			
Total	32,500	16,000	− 16,500
From Germany	3,500	2,600	− 900
„ United States	12,000	11,000	− 1,000
„ Great Britain	2,000	1,500	− 500
„ Italy	15,000	700	− 14,300
Telegraph apparatus, including wireless—			
Total	3,000	10,000	+ 7,000
From United States	700	1,200	+ 500
„ Great Britain	2,500	8,800	+ 6,300
Telephone apparatus—			
Total	4,000	4,000	—
From United States	3,000	2,000	− 1,000
„ Great Britain	200	700	+ 500
Lighting fittings—			
Total	18,000	18,400	+ 400
From Germany	9,000	7,900	− 1,100
„ United States	6,000	4,500	− 1,500
Heating and cooking apparatus—			
Total	1,500	6,000	+ 4,500
From Germany	500	1,300	+ 800
„ United States	900	3,500	+ 2,600
Cables of copper wire—			
Total	86,000	84,000	− 2,000
From Germany	1,400	9,500	+ 8,100
„ United States	3,000	7,400	+ 4,400
„ Italy	79,000	24,000	− 55,000
„ Great Britain	—	31,000	+ 31,000
Electric bells—			
Total	700	700	—
Insulating tape—			
Total	1,700	1,700	—
Covered copper flex—			
Total	8,400	6,200	− 2,200
From Germany	3,200	2,600	− 600
„ United States	3,500	1,200	− 2,300
Meters and instruments—			
Total	2,800	4,100	+ 1,300
From Germany	1,600	1,400	− 200
„ United States	1,000	1,800	+ 800
Metal filament lamps—			
Total	24,000	29,400	+ 5,400
From Germany	12,800	12,400	− 400
„ United States	8,000	9,000	+ 1,000
„ Holland	2,400	6,800	+ 4,400
Magnetos—			
Total	1,300	2,500	+ 1,200
From Germany	300	400	+ 100
„ United States	700	1,700	+ 1,000
Electric light meters, domestic—			
Total	4,000	1,900	− 2,100
From Germany	3,700	800	− 2,900
Motors up to 1 h.p.—			
Total	1,400	900	− 500
Switchboards—			
Total	3,000	27,800	+ 24,800
From Germany	1,400	3,700	+ 2,300
„ United States	600	21,400	+ 20,800
„ Great Britain	500	100	− 400
Fans—			
Total	1,500	2,600	+ 1,100
From Germany	400	—	− 400
„ United States	300	400	+ 100
„ Italy	600	2,200	+ 1,600
Current transformers—			
Total	11,000	28,000	+ 17,000
From Germany	7,400	1,500	− 5,900
„ United States	2,000	15,000	+ 13,000
„ Great Britain	1,400	2,200	+ 800
Total of electrical goods and apparatus	265,000	349,000	+ 84,000
From Germany	63,000	74,000	+ 11,000
„ United States	79,000	129,000	+ 50,000
„ Great Britain	12,000	57,000	+ 45,000
„ Italy	*99,000	56,000	− 43,000

* Practically all cables.

Frequency Variations in Thermionic Generators.

By LIEUT.-COL. K. E. EDGEWORTH, D.S.O., M.C., Royal Signals, A.M.I.E.E.

(*Abstract of paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

FOLLOWING a reference to the variations of frequency which occur in the pendulum-controlled mechanical oscillating systems, the phase relationships of currents and potentials in a thermionic generator are examined, and it is shown in the paper that the frequency of the oscillations is affected by the coupling between the grid and anode circuits. Equations are obtained which give the difference between the frequency of the oscillations generated and the resonant frequency of the tuned circuits; they show that the variations of frequency connected with the method of coupling are analogous to the reversible variations existing in a pendulum-controlled clock. With normal coupling the thermionic generator goes "slow," with reversed coupling it goes "fast," and with resistance coupling the variation disappears. Three "irreversible" variations of frequency are connected with a change in the (i) effective inductance of the circuit which occurs when the oscillation is free instead of forced; (ii) the resonant frequency of a damped circuit which occurs when the oscillation is free instead of forced; and (iii) associated with the presence of harmonics in the e.m.f. generated by the valve. Certain points in the design of thermionic generators employing resistance and reversed coupling are discussed; the experimental results obtained with various types of circuit are explained in terms of the theoretical variations previously discussed, and the characteristics of different types of constant-frequency generators are then compared. The practical applications of the results fall into two main classes, namely, wave-meters and transmitters (including master oscillators). In the case of power-driven generators, the high- and low-voltage current will usually be obtained from the same machine, and changes of voltage will presumably be of the same character. It is possible, therefore, to balance changes in anode voltage against changes in filament voltage, and a very close regulation should be obtainable in this way. Assuming a 10 per cent. variation in the voltage of supply, it seems quite possible to reduce the frequency variations to something of the order of 1 in 50,000, or 200 cycles per second at a frequency of 10,000,000.

In the case of the heterodyne wave-meter, a lower order of accuracy is likely to prove sufficient. The instrument would be adjusted so as to make it independent of variations in filament voltage, leaving only the residual frequency variations

associated with changes of anode voltage. These are considerably reduced by the adjustments made in connection with the filament voltage, and are of the order of 1 in 20,000 for a change of 10 per cent. in the voltage of supply. If necessary, they may be still further reduced by using a high anode voltage (nearly high enough to stop the oscillations altogether).

Three solutions of the problem of constructing a constant-frequency generator are referred to as: (i) The rheodyne generator; (ii) the orthodyne generator with grid bias, and untuned grid circuit; and (iii) the antidyne generator with grid bias. These three methods have not yet received sufficient trial to enable one to speak very decisively as to their merits, but their probable advantages and disadvantages may be indicated.

The *rheodyne generator* is more complicated than most types of orthodyne generator, as it involves the use of two tuned circuits and an arrangement for neutralising the stray capacity coupling. It does not, however, impose any restriction on the amplitude of the oscillations, and appears to be specially applicable to small transmitters in which it is not desired to incorporate a master oscillator.

The *orthodyne generator*, in conjunction with grid bias and an untuned grid circuit, appears to involve a considerable reduction in the amplitude of the oscillations generated, which would render it unsuitable for use in actual transmitters, although it would be suitable for wave-meters and master oscillators. It has the advantage of simplicity and employs only one tuned circuit.

The position of the *antidyne generator* with grid bias is rather difficult to define. The Colpitts circuit with suitable grid bias seems to have considerable possibilities, but the author is unable to say whether a sufficiently constant frequency is obtainable without some sacrifice of amplitude. The antidyne generator with an untuned anode appears to be less advantageous than the orthodyne generator with an untuned grid.

Regarding future possibilities, the employment of the thermionic generator which will keep its wave-length constant within 1 part in 50,000 will make heterodyne reception possible on wave-lengths of 30 m. or less, and the production of such a generator now appears to be a practical possibility. Variations in wave-length due to changes in aerial capacity have already been reduced to a low figure by the use of master oscillators, and the employment of a constant-frequency circuit for the master oscillator would appear to remove any troubles connected with the voltage of supply.

The development of heterodyne wave-meters which will give an accuracy of 1 part in 10,000 is another interesting possibility. There are a number of details in the design of such an instrument which require further study, but now that variations connected with the voltage of supply have been removed, there is no reason to suppose that any of the outstanding difficulties are insuperable.

For proper modulation radio-telephony requires a band of 10,000 or 20,000 cycles, but a very much narrower band is theoretically sufficient for wireless telegraphy, and the number of channels of communication which is theoretically available on the shorter wave-lengths is very great. The number of channels actually available at the present time does not approach these theoretical limits, but is determined by the unavoidable variations in the wave-length of transmitters. Any method which will reduce the variations in wave-length of short-wave transmitters will automatically increase the number of channels of communication available for practical use.

Radio on Aircraft.—Another daring seaplane flight was begun on January 22nd by Major Franco, of the Spanish Royal Air Service, accompanied by Captain Ruiz de Alda, a specialist in wireless telegraphy and aerial navigation, and a mechanic, who set out from Spain for the Argentine. The total distance covered was 1,800 miles, and the flight took about eight days. The machine was specially equipped for the trip with a Marconi AD6 aircraft telephone transmitter and receiver of the type which has been adopted as the standard fitting for British civil aircraft. A Marconi type 14 direction finder was also fitted for navigational purposes, and the Marconi Co. arranged with its affiliated wireless companies in South America to keep in touch with the seaplane when it approached South America. The King of Spain issued a royal order in which he conveyed thanks to the Compañia Nacionel de Telegrafia sin Hilos, Madrid, for the assistance which it gave to Major Franco, and for the arrangements which it and Marconi's Wireless Telegraph Co. made with other associated wireless companies in Brazil, the Argentine, Canada, and the United States for co-operation.

A New Peril.—According to *Science Service*, amongst the items of scientific progress in 1925 was the following:—Professor Gilbert N. Lewis announced a new theory of radiation based on the Einstein view of time, which makes a distant star and the eye-ball of an observer come into virtual contact.

Exide Service.

A New Depôt at Acton.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., in the furtherance of the excellent service facilities which it is providing all over the country, as well as abroad, has recently opened a new depôt at Lexden Road, Acton, to serve the South of England. The premises were formerly a garage belonging to the London General Omnibus Co., Ltd., and have a floor area of 25,000 sq. ft., all on the same level. The new premises serve a fourfold purpose; they are at once a stores, a repair depôt, a charging depôt, and assembly shops. The stores section is in efficient communication with the company's works at Clifton Junction, and a fleet of petrol and electric vehicles is available to provide stocks for Exide service depôts at short notice. The repair organisation deals not only with the company's batteries, but also those of any other make. An extensive room is provided for battery charging; it has a floor area of 8,000 sq. ft., and motor-generator equipment capable of dealing with a very large number of accumulators. Arrangements are made for the speedy replacement of exhausted vehicle batteries by others fully charged, and there is a spacious covered yard in which waiting vehicles can be parked. The accompanying illustration conveys an idea of the extent of the battery-charging room and its equipment. It was noticed during a recent inspection that the leads are either clipped to the accumulator terminals, or where lead terminals are fitted connection is made by fixing a bare copper wire with a tap from a hammer—very simple but quite efficient. An ample stock of plates of all types is maintained, as well as containers, crates, &c. The new depôt is well staffed to ensure quick attention, and is already doing an extensive business in each of its departments.

The New Acton Exide Depot—Battery-charging Room.

Water Power in Italy.—In *Annali de utilizzazioni delle Acque*, Vol. 2, No. 2, 1925, Mr. C. Bonomi supplies the following table, which shows the progress that has been made in the development of water power in Italy from the end of 1920 to the end of 1924:—

Province.	End 1920.	End 1922.	End 1924.
North Italy.			
Piedmont	365,530	452,885	532,882
Liguria	14,660	15,348	22,060
Lombardy	326,309	387,804	424,810
Venice	76,046	84,394	134,281
New provinces ...	81,699	81,699	84,623
Middle Italy.			
Emilia	17,813	25,679	29,379
Tuscany	20,527	22,887	27,489
Marche	29,892	38,526	42,310
Umbria	168,363	200,501	200,501
Latium	39,031	40,031	45,035
South Italy.			
Abruzzi and Molise ...	92,248	100,426	104,029
Campania	20,268	57,148	57,148
Apulia	—	4,400	4,400
Basilicata	—	1,000	2,153
Calabria	710	4,082	6,592
Sicily	11,400	14,832	14,832
Sardinia	—	—	10,380
Totals	1,273,496	1,513,642	1,742,904

While these developments embrace the whole of Italy, it will be noted that the greatest progress has taken place in the north. Whether or not the whole of this water power is applied to hydro-electric purposes is not stated, but certainly the greater proportion is thus used. It will be noted that, while there is nothing sensational in the progress of water-power utilisation in the period covered by the above figures, approximately half a million horse-power has been added to the water power harnessed in Italy since the end of 1920.

The Institution of Electrical Engineers.

Annual Dinner of the North-Western Centre.

The semi-jubilee dinner of the North-Western Centre of the Institution of Electrical Engineers took place at the Midland Hotel, Manchester, on January 26th, the chairman of the centre, Mr. A. G. Ellis, presiding. There were about 250 present.

The toast of "The City of Manchester and the Royal Borough of Salford" was proposed by Sir Holberry Mensforth, K.C.B., C.B.E., Director General of Factories, and was responded to by Alderman Delves, the Mayor of Salford. Councillor Mitchell, the Lord Mayor of Manchester, was unable to be present.

Lieut.-Col. Sir Joseph Nall, T.D., D.S.O., M.P., proposed the toast of "The Institution of Electrical Engineers." He said in the future development of electricity in this country care must be taken not to embark upon schemes which involved enormous calls upon the public purse, and not to hamper by legislation the ordinary development brought about by private business. There was a wide field for investigation and legislation in the matter of standardisation, but whilst they could achieve much by standardisation and encourage and guide enterprise by legislative action, they might also do a great deal of harm unless care was taken. Whatever advantages might ultimately accrue from the system of railway grouping, the immediate effect had been to hold up schemes of electrification which would have been carried out by this time if the railway companies had continued their separate existence. Some schemes had apparently been abandoned owing to the indirect influence of coercive legislation. He hoped and believed the Government's electricity proposals would not be unduly coercive nor restrictive, but would remove many difficulties and pettifogging restrictions, and that the results, in the next few years, and also in the years to come, would be of inestimable benefit to the people concerned.

Mr. R. A. Chattock, President of the I.E.E., who was received with musical honours, replied to the toast. He said there was nothing wrong with the I.E.E. One of its chief duties was to adapt itself to the needs of its members; and in that connection he reminded his audience of the Wireless Section which was now being developed. It was hoped that it would help in the development of the wireless industry by getting the general body of the members interested, and making them feel that they were being catered for by the Institution. Recently, a proposal had been made to form a separate Institute of Wireless Engineers; he could not speak too strongly against it. Sectional institutions would fritter away the strength of the parent Institution.

He thought the industry would be helped along very considerably by the British Industries Fair. An Electrical Trades Section was being started; it was going to be very representative, and those who went to see it would find it very advantageous. Considering the number of visitors who were coming from abroad, it should have a very good effect upon the electrical trade of this country.

Generally speaking, the Government's electricity scheme had met with approval, though certain sections would undoubtedly create opposition. The scheme was explained in greater detail at a conference he recently attended at the Ministry of Transport, but the explanation was confidential. That was very unfortunate, because he felt that the greater the publicity given to the scheme, and the more it was thrashed out by those interested in it, the better it would be for the country. They did not want these schemes to be carried out in a hole-and-corner fashion. If there was something which they felt was not good for the country, they ought to be allowed to say so publicly, to criticise it, and to try to get it put right. The President of the Birmingham Chamber of Commerce had said manufacturers were very dubious about the scheme, and they felt it was useless to try to discuss it unless they had before them the basic figures on which the scheme was built. It was all very well for a Government Department to say: "We have investigated this matter, we have gone into the figures, and we are satisfied"; but, as intelligent citizens, they ought to have the figures.

On several occasions this country had been accused of being backward in electrical development; comparisons with America and the Continent were made. He could not see why that attitude should be taken up, because the British electrical industry was as efficient as any in the world. Development was going on at an increasing rate. Birmingham was providing for 700 to 1,000 new customers per month. That did not look like falling behind; they were going ahead, and at this rate would soon catch up to America. No warnings or stimulants were needed; he really did not see that there was any need for the criticism and pessimism of which so much was now heard.

With regard to the development of rural areas, they were being treated unfairly. The big industrial centres were anxious to get back into the country and to open it up, but the delays and obstructions were disheartening. Even after an Order had been obtained, it took months to get wayleaves. He was sure the Ministry of Transport could help in those matters. He wished every success to the scheme—subject to reservations. Before agreeing with it, they wished to be satisfied that the dislocation of their business was justified.

The toast of "Our Guests" was proposed by the chairman in an admirable speech. In responding, Sir PHILIP NASH, K.C.M.G., C.B., referred to the electricity proposal; he said that in his opinion it was a non-party measure, and it had three great advantages—it was conceived on big and broad lines; it was constructive—not obstructive nor destructive; and in the main it was not impracticable.

Mr. S. L. PEARCE, C.B.E., M.Sc., who also replied to the toast, said the work which confronted the Electricity Commissioners was extremely complex, and the difficulties were perhaps made greater at the present time because they had to take care that their actions to-day would not hamper the carrying-out of the Government proposals. For full details of the proposals they must necessarily wait till the presentation of the Bill. It had been questioned whether a new body such as the proposed Electricity Board was needed; it was the definite conclusion of Lord Weir's Committee that it was necessary, to give full effect to the scheme, and there was no statutory body in existence which could possibly fill the same rôle. It might be regarded as a kind of Super-Joint Electricity Authority for the whole country. There was no intention to abolish the existing regional authorities, which had done excellent work, and would continue to perform most useful duties; certain powers of the Board might be delegated to them as its agents. The consumption of electricity per head could be greatly increased by the use of cheaper energy and cheaper apparatus, and both these advantages should result from the scheme. In the next 15 years they hoped to advance from 2,400,000 kW installed to 8,000,000 kW, and from an output of 5,500 million kWh sold to 21,000 millions a year. It was essential that they should take a long view. Those who would be affected by the proposals were entitled to be satisfied that the scheme was sound. It had been urged that the economies effected would be offset by the cost of the transmission lines, of standardisation, and of administration; they might be sure that these matters had been most carefully investigated, and a mass of figures had been compiled and confirmed by eminent advisers. The various undertakings, obviously, could not all share the benefits equally, but if it could be shown that any interest were prejudicially affected by the scheme, he was sure that sympathetic consideration would be given to representations to that effect. It was not sought to set up fettering Government control, but to work through and assist the existing agencies as far as possible. The Commissioners had no axe to grind and no sectional interests to serve; their one aim was to develop the electricity supply industry in this country.

Mersey and North Wales Centre Dinner.

The Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers held its annual dinner on Friday last at the University Club, Liverpool, when a large number of members and visitors were present, and Mr. A. E. Malpas, Wh.Sc., M.I.E.E., chairman of the centre, presided.

"The Institution of Electrical Engineers" was submitted by Mr. J. SANDEMAN ALLEN, M.P., who expressed admiration of the work of the Institution. The work that was done by electrical engineers was so great and important, that it could only be adequately conceived by viewing it in the national and international sense. It was only by industry adapting itself to modern needs and requirements that the country's trade would be maintained and developed. Electrical engineers were not straggling individuals, but were organised into a great national Institution, with 50 years' experience behind it, and a total strength of 11,740 members.

Mr. R. A. CHATTOCK, president of the Institution of Electrical Engineers, responded, and commented on the fashion of establishing new institutions. Referring to the training of engineers, he said he had received communications from students who said they had had no opportunities of getting on. They expressed the feeling that they were being sidetracked. If that spirit was interpreted into words it would militate against the Institution. If there was no room in this country for engineering students, there was plenty of room in the Empire, and they could not do better than get out into the world. The establishment of lighting development bureaux in various towns would have very far-reaching effects in the electricity supply industry. He hoped the idea would be extended to the cooking and heating part of the business. Supply engineers alone knew what an excellent load factor would be provided, and a high load factor meant cheap production. As to the Government scheme, he hoped it would not be made a political stunt. He felt that the politicians were trying to go a little too fast, as developments of that kind could only come about gradually. The efficiency of power stations had trebled during the last 15 years, and the last word had by no means been said. He was of the opinion that the Electricity Commissioners should consult the engineers in the industry and thrash out with them all the details of a scheme. He could say, however, that a more or less concrete scheme had been evolved, but the details had not yet been made public. He was glad that the Minister of Transport had been called in to discuss the matter. Such

conferences would be a great benefit to the industry and the country. He was sure that all would be glad that the Government did not intend to subsidise the industry. Subsidies were not only disheartening, but disintegrating, undermining energy and enthusiasm that otherwise would be put into the work.

Mr. A. G. ELLIS, chairman of the North-Western Centre, proposed "The City of Liverpool," and took the opportunity of commenting on the friendly relations and the good fellowship between the local Centre and the North-Western Centre. In the electrical engineering manufacturing business, exports amounted to 30 per cent. of the total production, most of which was shipped from Liverpool. The export trade in British electrical manufactures was practically one-third of the total electrical export business of the world, the other main portion being shared by Germany and America. The Liverpool electricity supply system was laid down on such lines that it would be able to link up with other concerns when standardisation was introduced.

The LORD MAYOR OF LIVERPOOL responded, and spoke of the enormous developments of the Liverpool tramway undertaking and the electric power and lighting department.

Mr. B. WELBOURN proposed "The Guests." The electrical engineering industry in this country, he said, was not so far behind as it was often represented to be. There was one area, the North-East Coast, where the consumption was 800 kWh per head of the population per annum. At St. Helens the figure was over 1,000, and in the smaller town of Prescot it was 500. Industrial Lancashire was a big consumer, but the chief backwardness was in the non-industrial and agricultural areas of the country. In those places there was very little demand.

Mr. T. R. WILTON, M.Inst.C.E., President of the Liverpool Engineering Society, complimented electrical engineers on solving one of the greatest problems of town life—doing away with the great curse of smoke.

The final toast, that of "The Chairman," was proposed by Mr. H. H. HARRISON, and acknowledged by Mr. A. E. MALPAS.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 27th :—

Honeycomb. No. 459,684. Class 8. Electrical coils for use in radio-telegraphy and telephony.—Igranic Electric Co., Ltd.

Radio XXX super sensitive crystal (lettering and design). No. 462,285. Class 8. Instruments, apparatus and accessories for use in connection with radio-telegraphy and telephony.—M. Feldman, 2a, Barrack Street, Meanwood Road, Leeds.

Reco. No. 463,073. Class 8. Radio-telephonic receiving sets and parts thereof.—H. J. Roberts, trading as the Roberts Engineering Co., 110, Old Street, E.C.1.

Zenite. No. 463,595. Class 8. Electrical resistances.—R. Lehmann and Co., Ltd., Zenith Works, Willesden Green, N.W.2.

G.K. Liquitone (lettering and design). No. 463,537. Class 8. Radio-telephonic receiving sets and parts thereof.—Gladwell & Kell, Ltd., 258, Gray's Inn Road, W.C.1.

Filtron. No. 465,534. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—E. A. Graham, trading as Alfred Graham and Co.

B. & T. (lettering and design). No. 464,651. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Baird & Tatlock (London), Ltd., 14-15, Cross Street, E.C.1.

Magnatone Aerial Encircles The World (lettering and design). No. 465,110. Class 8. Aerials for use in radio-telephony.—Sparklets, Ltd., Angel Road, Upper Edmonton, N.18.

Marconite. No. 464,994. Class 50. Electrical insulating substances of asbestos, mica, resin, oils or bitumen.—Marconi's Wireless Telegraph Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

28,459. "Diaphragms to be used in electric batteries." Dr. M. Wilderman. September 12th, 1924. (245,252.)

1924.

10,905. "Electromagnetic control arrangements for automatic punching machines." J. R. C. August and E. K. Hunter. March 3rd, 1925. (245,364.)

16,414. "Radio receiving systems." Electric Apparatus Co. July 18th, 1923. (219,305.)

21,337. "Electric switches." A. E. White (Elevator Supplies Co., Inc.). September 9th, 1924. (245,484.)

23,467. "Devices for the expansion or diminution of letters, figures, and the like for illuminated advertising or like purposes." H. M. Black. October 4th, 1924. (245,492.)

23,709. "Apparatus for the rectification of alternating current." H. G. Andre. November 13th, 1923. (224,871.)

23,710. "Apparatus for the rectification of alternating current." H. G. Andre. April 30th, 1924. (Addition to 224,871.) (233,292.)

23,714. "Auxiliary lighting circuits for electric train-lighting installations." J. Stone & Co., Ltd. (C. J. H. Bolton). October 7th, 1924. (245,502.)

23,729. "Electric switching-keys for high-frequency circuits." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and B. B. Grace. October 7th, 1924. (245,505.)

23,848. "Double-pole electrical connection." P. Tracy. October 8th, 1924. (245,512.)

23,926. "Modulating systems for electric signalling and the like." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). October 9th, 1924. (245,516.)

23,948. "Means for adjusting radio instruments or the like." Igranic Electric Co., Ltd., and G. F. Dandridge. October 9th, 1924. (245,518.)

24,004. "Electrical translating apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. (Addition to 199,480.) (245,522.)

24,005. "Electric relay apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. ((245,523.)

24,017. "Electrical thermo-sensitive apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. (245,524.)

24,024. "Railway traffic-controlling apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. (245,525.)

24,122. "Metal-clad electric switchgear." A. Reyrolle & Co., Ltd., and J. Mirrey. October 11th, 1924. (245,529.)

24,253. "High-speed telegraph systems." T. G. Thornblad. February 7th, 1924. (228,855.)

24,625. "Telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. October 16th, 1924. (245,532.)

24,639. "Construction of aerial 'wire' for wireless broadcast reception." F. F. Sharp and R. R. Stell. October 17th, 1924. (245,533.)

24,804. "Electric measuring instruments." G. Wall and Metropolitan-Vickers Electrical Co., Ltd. October 18th, 1924. (Cognate application 11,033/25.) (245,536.)

24,827. "Air-spaced coil for use in wireless telegraphy and telephony and also for use for electrical purposes." Lord Egerton of Tatton (M. Egerton). October 18th, 1924. (245,537.)

24,887. "Variable electric condensers." A. E. Alexander (U. S. Tool Co., Inc.). October 20th, 1924. (245,538.)

26,119. "Inductance-coil holders." H. Stevens and A. J. Stevens & Co. (1914), Ltd. November 3rd, 1924. (245,549.)

26,274. "Battery terminals." A. H. Sheppard and Ever Ready Co. (Great Britain), Ltd. November 4th, 1924. (245,550.)

27,027. "Process and apparatus for carrying out circuit reactions under very high pressures." J. Y. Johnson (Badische Anilin & Soda Fabrik). November 12th, 1924. (245,553.)

27,117. "Telephone repeater circuits." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). November 13th, 1924. (245,554.)

27,262. "Electrically-operated make-and-break devices for use in horns or warning devices for vehicles, or for use in electric bells, interrupters for spark coils, and the like." Fuller's United Electric Works, Ltd., and A. P. Welch. November 14th, 1924. (245,556.)

27,367. "Tuning-coil holder." H. A. Hickson. November 17th, 1924. (245,557.)

29,274. "Plug-in fittings or attachments for inductance coils for wireless receiving or transmitting apparatus or for other uses." F. H. Alston. December 6th, 1924. (245,569.)

29,592. "Electric switch plugs." J. E. S. E. Honor and C. W. H. Honor. June 19th, 1925. ((245,572.)

29,633. "Valve-holders for wireless receiving sets." C. Pressland. December 10th, 1924. (245,574.)

30,765. "Automatic excess-heat protector, especially for electric machines and apparatus." W. Hickel and O. Pletscher. December 22nd, 1924. (245,581.)

1925.

248. "Electrical terminals." E. M. Taunton. January 5th, 1925. (245,586.)

602. "Diaphragm sounders." F. Krupp Germaniawerft Akt. Ges. October 10th, 1924. (Addition to 225,569.) (241,150.)

1,253. "Grid resistances." Rheostatic Co., Ltd., and L. Satchwell. January 15th, 1925. (245,598.)

1,987. "Automatic switches for use in telephone or like systems." J. E. Pollak (Telephone Apparat Fabrik E. Zwietusch & Co., Ges. Kommanditges.). January 22nd, 1925. (245,606.)

2,594. "Protective device for limiting the supply of current to and automatically switching-off electric current-consuming apparatus." Maschinentabrik Oerlikon. February 25th, 1924. (230,027.)

3,061. "Automatic switches for use in telephone or like systems." J. E. Pollak (Telephone Apparat Fabrik E. Zwietusch & Co., Ges. Kommanditges.). February 3rd, 1925. (245,615.)

5,239. "Method of and means for operating mechanically-driven rectifiers in connection with electric transformers." Lodge Cottrell, Ltd. (Lurgi Apparatebau Ges.). February 25th, 1925. (Convention date not granted.) (230,073.)

6,402. "Formers for use in the winding of electric inductance coils." Fuller's United Electric Works, Ltd., and A. P. Welch. March 9th, 1925. (245,634.)

6,440. "X-ray tubes." Naamlooze Vennootschap Philips Gloeilampenfabricken. March 10th, 1924. (230,497.)

6,649. "Coating of welding electrodes." Siemens-Schuckertwerke Ges. March 12th, 1924. (230,831.)

6,675. "Jacketed welding electrodes." P. C. Rushen (Siemens-Schuckertwerke Ges.). March 11th, 1925. (245,635.)

7,089. "Coil-holder for wireless and like apparatus." E. Shipton and B. Phillipson. March 16th, 1925. (245,637.)

11,048. "Automatic electrode-regulating apparatus for electric furnaces." Akt. Ges. Brown, Boveri et Cie. May 7th, 1924. (233,692.)

14,391. "Ignition devices for internal-combustion engines." M. J. B. Barbarou. July 26th, 1924. (237,566.)

14,709. "Flashlight containers." P. R. Puckett. June 5th, 1925. (245,661.)

15,073. "Electrically-operated vacuum cleaners." G. R. Bimm. June 10th, 1925. (245,662.)

17,332. "Electric luminous tubes." General Electric Co., Ltd. February 9th, 1925. (245,672.)

18,573. "Alternating-current induction meters." Dr. O. T. Blathy. August 23rd, 1924. (Addition to 201,573.) (238,863.)

18,601. "Electrical condensers." J. Bate and C. A. Vandervell & Co., Ltd. July 21st, 1925. (245,676.)

19,329. "Combined electrical condensers and resistance units, more especially for use in radio circuits." Dubilier Condenser Co. (1925), Ltd. May 2nd, 1925. (245,680.)

19,845. "Electric flashlights." National Carbon Co., Inc. December 1st, 1924. (243,673.)

20,477. "Device for regulating the pressure of mercury-vapour in the working chamber of mercury-vapour apparatus, and more particularly in mercury-vapour rectifiers." Dr. W. Dallenbach. August 15th, 1924. (238,565.)

26,704. "Diaphragms for telephone instruments." E. V. Mackintosh and C. French. October 24th, 1925. (245,704.)

29,233. "Direct-current ampere-hour meters." G. Wall and Metropolitan-Vickers Electric Co., Ltd. October 18th, 1924. (Cognate application 7,475/25.) (Divided application on 245,536.) (245,707.)

32,798. "Method of and apparatus for converting electric power." P. C. Rushen (Hazeltine Research Corporation). July 4th, 1924. (Divided application on 218,675.) (245,708.)